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AGAZINE

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+

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BELL TELEPHONE SYSTEM

Popular Mechanics Magazine

H. H. WINDSOR, Founder H. H. WINDSOR, Jr., Editor and Publisher

April, 1940 Vol. 73, No. 4

IN THIS ISSUE

Blind Landings Next - - - - - - 481
Handling Money by the Ton - - 488
The World's Biggest Chess Game - Coloroto
Golden Fleece in Your Back Yard - 508
Fog of War - - - - - - - - - 514
Champions in the Making - - - 520
Step Savers for Millions - - - - 526
Heroes of the Deluge - - - - - 530
Mechanizing the Small Farm - - 536
The Largest Thing Ever Built - - 546
Cameraman at the Front—Part II - 552
In the Air with the Riggers - - - 558
Fighting Crime by Remote Control - 562
Lightning on Skates - - - - - 567
Testing the Roads of the Future - - 572

(Continued on next page)

And Now the Plastics Era

TAKE it from scientists who know, the plastics era is arriving. The time is not distant, they say, when you will live in a house of plastics, drive an automobile of plastics, fly an airplane with molded wings and fuselage; you'll even be clothed in plastics. Right now the United States produces 160,000,000 pounds per year of thirteen types of plastics, and it's a hundred to one you can't tell whether that diamond necklace you saw was of genuine diamonds or gems cut from Lucite, one of the newer plastics. The eight-page Coloroto section in May reveals "The Era of Plastics" in color.

Setting Traps for Enemy Ships

UNNOTICED while sirens shriek of an air raid and guns bark at invaders four miles high, a slow-flying seaplane sweeps low off the English coast. Aboard it a powerful mine with parachute attached rolls on a miniature railway to the hatch, drops into the sea. An article next month tells how these deadly mines are laid and how they are combated.

Next Month

LIGHTNING may be ripping the sky, a streetcar may rumble past, the vacuum cleaner may buzz, but orchestral music pours in sweet and static-free from the new frequency-modulation radio receiver. "FM" is already on the air in New England, stations around the country are getting ready for it although it may mean replacing $75,000,000 in transmitting equipment. How soon will this "perfect" radio reach your home? Read "'Wobbly' Radio Wave Conquers Static" in May.

Doodlebug Grows Up

ONCE upon a time people hunted buried treasure with "doodlebugs" and other people laughed. But now the doodlebug, come suddenly of age, calls itself a "radio detective" and with scientific precision spots a leak in an underground gasoline line and saves you from an explosion, hunts automobiles buried by flood, and is searching Hollywood Bowl for the treasures of Maximilian and Carlotta. All of which makes interesting reading next month.

Chemistry Finds Oil

EXPLORING for oil with costly drills may not be necessary much longer. Chemists are developing a method of testing surface soil and telling, from the few hydrocarbon molecules that have filtered up from the buried petroleum, just where the oil deposits lie. "Chemistry Explores for Oil," appearing in May, is an account of this brand new development.

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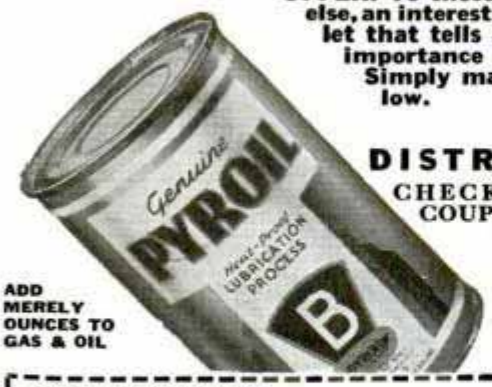

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(Contents—Continued)

AUTOMOTIVE

Booster engine for light truck....492
Polarized headlights present problems....492
Tire chains put on easily with clamp....496
Telescope mounted on car window support....518
Trailer with telescoping top....518
Truck rides on tractor tread or wheels....529
Crankcase fumes absorbed into carburetor....533
Hydraulic brake system refiller on casters....534
Jack shows power of vacuum to shift gears....534
Larger license plate costs more to push....534
Extension arm marks tires of parked cars....545
Road signs used in test on drivers' eyes....550
Portable air-jack raises end of car....557
Pump removes hydraulic-brake air-pocket....565
Tractor fighting fire carries its own water....571
"Crutches" support car to release floor jack....574
Collision armor all around car....575
Advance in comfort of new car shown....576
All-weather radiator front....576

AVIATION

Water wings keep plane afloat....496
"Airport on wheels" has shop and lights....513
Safety fuels must be injected into engine....513
Flying electric sign writes messages....519
Air travelers entertained by radio programs....533
Streamline generator ends vibration source....534
Marker lights for seadrome permit night landings..574

BOATS AND BOATING

Motorized iceboat pushed by spiked wheel....529
"Sea sled" has twin hulls like catamaran....540
Wings on liner funnel deflect smoke from deck....560

CONSTRUCTION

Tunnel laid in sand like pipeline....524
Glass blocks set in frames without mortar....528
Bridge traffic control tower....541

HOUSEHOLD

Gas meter read from outside by periscope....544
Handy meat and bread slicer is hand-operated....566
Spring sash balance replaces weights....566
Pinless clothesline holds with wire loops....570
Twist-lock electric plug and socket....574

MODELS

Steam engine and boiler built to scale....492
"The Village Blacksmith" carved in wood....524
Model plane snaps aerial photographs....525

PHOTOGRAPHY

"Jig" board keeps a record of exposures....529
One-piece frame binds slide in alignment....540
Photoflash lamp for color day or night....561

RADIO AND ELECTRICITY

Portable X-Ray unit plugs in at bedside....518
Compact radio receivers of advanced design....615
Loop-operated battery receiver for portable use....616
Fifty-foot telescoping antenna mast....618
Hints for radio experimenters....619
Automatic record changer easily installed....620
Battery-operated radio interference locator....620
Double deck sight and sound receiver kit....620
High-gain preselector for short-wave receivers....620

SCIENCE AND INDUSTRY

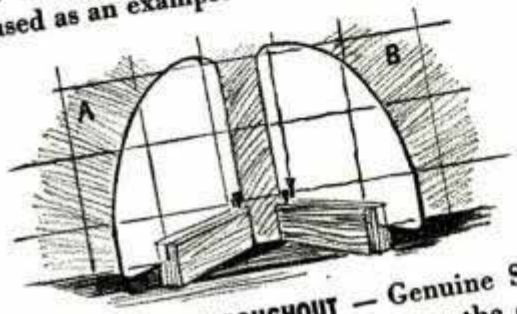
Corset on porpoise helps study heart action....487
Mechanical "sneezer" aids study of germs....493
Rate of heartbeat indicates span of life....519
Electricity gives metal a high polish....535
Planetarium shows date calendar began....540
Animals' eyes do not shine in the dark....541
Coal dust melts ice by absorbing sun's heat....544
Rugs tested by mechanical kicker....550
Why earthquakes come in groups is puzzle....550
Pear-shaped atom-smasher....561
Atomic racetrack helps study gases....575

(Continued to page 6A)

NOTES FROM A
CRAFTSMAN'S HANDBOOK

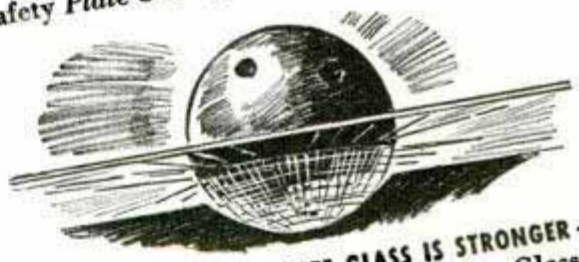
PLANNED VISION
in the 1940 BODY BY FISHER

The improvement of visibility involves a number of considerations — namely: the size of the glass areas, the use of distortion-free glass, and the angle at which the windshield is set. The 1940 Body by Fisher brings notable advances in each of these respects to each of the new General Motors cars. The new Chevrolet is used as an example here.



CLEARER VISION THROUGHOUT — Genuine Safety *Plate* Glass (A) entirely eliminates the distortion waves produced by ordinary Safety "window" or laminated sheet glass (B). Furthermore, tests show that this distortion-free glass reduces eyestrain 62%, greatly minimizes driving fatigue. The new Body by Fisher provides this better visibility for all passengers, through all glass areas, even in the lowest-price models.

MORE WIDTH, MORE RAKE TO THE WINDSHIELD—With the wider windshield, the driver's area of vision is considerably increased. With the windshield slanted 37°, glare is effectively reduced and overhead traffic signals are brought more readily into view. Similarly, improved positioning of the rear-view mirror and a 10% larger back window of curved Safety *Plate* Glass give a better view rearward.



NEW HI-TEST SAFETY PLATE GLASS IS STRONGER — Newly developed Hi-Test Safety *Plate* Glass is much stronger than previous types, actually cushions the blow. A 16-lb. bowling ball, dropped from a height of 6', fails to penetrate — is held in suspension by the plastic. This stronger, safer glass is used not only in the windshield — but in all door windows and Ventipanes of the 1940 Body by Fisher on the Chevrolet sedan pictured on this page.

They're saying, *"Chevrolet's First Again."* And there are a host of reasons why in its new Body by Fisher. In this Chevrolet Special DeLuxe sedan, for instance, you'll find more room than ever before and the stronger, safer, new Hi-Test Safety *Plate* Glass is not only in the windshield—but in all door windows and Ventipanes, as well.

UNISTEEL TURRET TOP

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(Contents—Continued)

SPORTS

Tennis on roller skates combines two sports.....487
Ten-foot bicycle carries four riders.....525
Packsack on steel frame holds week's supply.....528
Captive golf ball shows quality of stroke.....570

TOOLS

Many-purpose air gun sprays molten metal.....551
Lightweight sander operated with one hand.....560
Illuminated magnifier sees inside machinery.....571

WAR

"Blackout" lamp for London gives subdued light...565
Table map aid to air-raid defense.....571
Motorcycle leads bus through fog in blackout.....576

MISCELLANEOUS

"Baby" Diesel-electric locomotive.....487
Porcupine rides in can and monkey wears "ruff"....493
Nine-wheel trailer rolls highway shoulder.....528
Expanding gas used to mine coal.....535
Periscope made of two mirrors.....541
Gripper bites into canvas and holds it.....544
Two-way lighter for cigarette and pipe smokers....544
Circular saw on tractor cuts logs.....545
Dummy tank at British training school.....557
Track built and abandoned last year.....560
Massive wagon wheels attract customers.....561
Doctor's self-cleaning goggles.....566
Earth gains weight from falling star dust.....566
Fire-escape ladder unfolds from any window.....570
Coke from charcoal and tar.....116A
Luminous wall paint lights room.....126A

Craftsman and Shop Notes

AUTOMOTIVE

Easy repair for radiator tubes.....638
Gauge for adjusting brake-shoe assemblies.....638
Old casings cushion loads on trucks.....638
Taking up play in fuel pump.....638
Air hose reinforced at bends prevents breaking.....639
Pocket makes reversible cushion for auto driver....639
Rope pads horse trailer.....639
Rubber gaskets made accurately with glass cutter..639
Clips keep trouser cuffs off car floor.....640
Paper keeps frost off windshield.....640

BOATS AND BOATING

Smooth boat propeller saves power.....600
Zephyr—a 14-ft. sailing dinghy—Part I.....604
Counterweights keep small boat in "stall".....609

FARMS

Clothespins anchor baby-chick pen to ground.....581
Auto casings on wagon wheels prevent mud chunks.623
Drive shaft used as tamping stick.....625
Staples prevent crowding of poultry on roosts.....634

HAND TOOLS

Burning initials in tool handles.....584
Clip holds small nails to start them.....602
Drilled block for starting screws.....602
Wire tongs to hold small parts.....602
Clamps guide starting drill in round work.....624
Stamp for terminal connections.....624
Removing short nipples.....631
Rubber holders for long-handled tools.....631
Slotted-jaw clamp holds work for drilling.....634

HOME IMPROVEMENTS

Shelves for that corner.....590
Pump recess in basement wall saves space.....600
Step sloping foundation to avoid cracks.....623

HOUSEHOLD

Bathroom cabinet slides between wall studs.....580
Solving household problems.....582
Portable sewing bag stands on the floor.....585
Dirty water kept out of cistern.....589
Woolens stored in cans protected from moths.....589
Jingle of bells on door announces caller.....593
Wood box on casters carries a large load.....593
Shield on curtain rod prevents snagging hem.....602
Fishing reel stores extra cord for household.....610

(Continued to page 8A)

When jobs are looking for men —thats news!

1 Look here, Frank – Two full columns of male help wanted – your kind of work!
Yes I noticed it – Last year at this time there wasn't half that much
2 H'lo, Frank – you're an office man – Do you know where we could get a manager for our Accounting Department?
Gee – I wish I could qualify!
3 You say Mary's husband just got a new job at double his old salary? – That settles it, Honey – the time has come for us to get out of the rut, too. I'm going to write LaSalle tonight!
4 1 year later —
I stayed late at the office, Honey, to get off my last examination paper – now I'm somebody!
That's swell, Napoleon – here's a letter that came today
5 Honey, look at this! – We're out of the rut at last! Doberry & Co. want me to come and see them – just the job I wanted. And say – am I glad I'm prepared for it!

. . . . . NOW IS THE TIME! . . . . . .

RIGHT **now, in many lines there is a search for really** *good* **men—managers, leaders—men who can take charge of departments, businesses, branch offices, and set things humming.**

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3-IN-ONE Oil

(Contents—Continued)

LAWNS AND GARDENS

New lawnmower roller made of pipe.....589
Killing black beetles in trees and shrubs.....600
Pipe makes seed trenches in garden.....600

PHOTOGRAPHY

Diffuser for floodlights.....611
Efficient print washer from ordinary tub.....611
Automatic developer for films.....612
Darkroom towel holders from shoe trees.....612
Finger grips to handle films.....612
Non-slip focusing cloth.....612
Simplified test for hypo.....612
Protecting ferrotype tins.....613
Tape checks distance when taking portraits.....613
Fly swatter diffuses enlargements.....614
Sheet of glass keeps paper from curling.....614

POWER TOOLS

Tool-post holder clamps work to drill press.....584
Magnifying glass on jig saw for fine work.....602
Keeping saws sharp.....621
Reamers and counterbores made in your own shop..626
Two belt kinks that help.....632

STORE AND SHOP

Scales carried on barrel when taking inventory.....624
Drawer pull on workbench holds steel wool.....625
Heavy pulleys dampen vibration of line shaft.....625
Jog block saves time when printing cards.....631
Spray jets for fresh vegetable racks.....633
Wrapping-paper rolls kept under counter.....633
Removing static from belts.....637

TOYS AND NOVELTIES

Dress up the child's room.....577
Folding table-top theater.....586
Dart shooter from clothespin and rubber band.....592
Learn to balance on this monowheel cart.....603
Seesaw pivoted on wooden bearings.....609
Variation of checker game is novel pastime.....610

WOODWORKING

Carpenters' square guides knife cutting veneer strips 580
V-grooves improve appearance of cupboard door...584
Groove cutter made from motor valve.....589
Glue spreader made from clothespin.....632

MISCELLANEOUS

Tissue paper aids in correcting typed sheet.....580
Spherical shell houses chrome dinner gong.....581
Rubber fishline reel easy to make.....584
Simple way to imitate block prints.....584
Scale on kite string to measure distance.....585
Funnel on blowtorch aids in burning paint.....592
Nail file points pencil.....592
Newspaper easily removed from open-end bag.....592
Quick connectors for small electric meters.....592
Sandbag holds ladder from slipping.....592
Non-stop mail express, Part I.....594
Paper spiral turns slowly on lamp.....599
Rubber caster cup removes smooth screw caps.....599
Whistling teakettle forms binnacle case.....599
Wren house from piece of auto casing.....600
Wooden dogs carry parkway numbers.....601
Collapsible picnic table takes little space in car.....603
Mail box swings to let machinery pass.....610
Small printing press serves as a duplicator.....623
Iron filings aid in driving pins.....624
Rubber-band holder for tags and labels.....624
Crochet hook aids in lacing belt.....625
Lineman strengthens safety belt with wire.....631
Paperhanger's brush cleaned with safety razor.....631
Rolled posters easy to tack when windy.....632
Surveyors' stakes pushed in ground with foot.....632
Test prods have self-contained current supply.....634
Detecting precious metals for pleasure and profit...635
Paper tabs on blueprints to prevent soiling.....637

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City.....*State*.....*Present Position*.....

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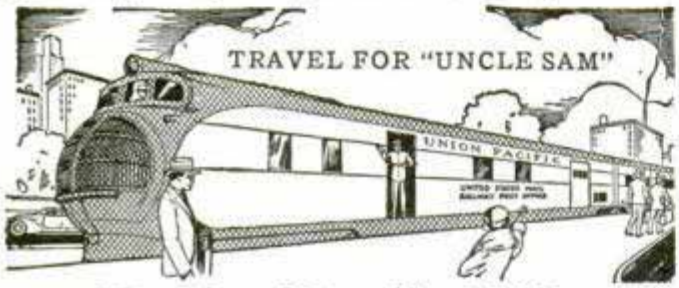

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Railway Postal Clerks on long runs usually work 3 days and have 3 days off duty or in the same proportion. During this off duty their pay continues just as though they were working. They travel on a pass when on business. When they grow old, they are retired with a pension.

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Clerks and Carriers now get $1,700 the first year on regular and automatically increase $100 a year to $2,100 and $2,300.

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Open to Men — Women 18 to 50. Entrance salary $1,200 — $1,440 year. Appointments as File Clerks and Clerks in the Departments at Washington, D. C., and elsewhere are made from this examination.

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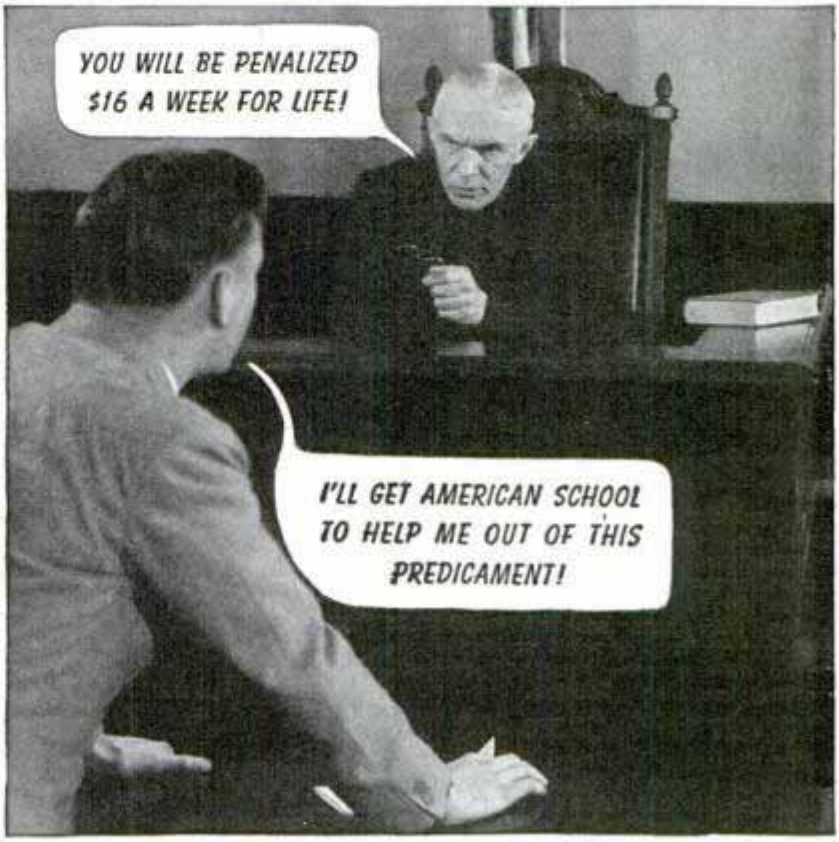

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HAVE YOU thought about *home study?* You look around you at your friends, neighbors and fellow employes: This one earns $10 a week more than you—that one earns nearly double—a third, though appreciably younger than you, seems to be making better progress. Why? How can you catch up with them? You know that literally *thousands* of ambitious men and women have won substantial Success through using their spare time at home to master the principles and practice of their chosen lines. How can HOME STUDY help *you* make good?

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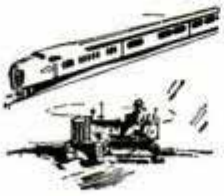

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Clip the coupon and mail it. I'm certain I can train you at home in your spare time to be a Radio Technician. I will send you my first lesson free. Examine it, read it, see how clear and easy it is to understand. Judge for yourself whether my course is planned to help you get a good job in Radio, a young growing field with a future. You don't need to give up your present job, or spend a lot of money to become a Radio Technician. I train you at home in your spare time.

Jobs Like These Go to Men Who Know Radio

Radio broadcasting stations employ engineers, operators, technicians and pay well for trained men. Radio manufacturers employ testers, inspectors, foremen, servicemen in good pay jobs with opportunities for advancement. Radio jobbers and dealers employ installation and servicemen. Many Radio Technicians open their own Radio sales and repair businesses and make $30, $40, $50 a week. Others hold their regular jobs and make $5 to $10 a week fixing Radios in spare time. Automobile, police, aviation, commercial Radio; loudspeaker systems, electronic devices, are newer fields offering good opportunities to qualified men. And my Course includes Television, which promises to open many good jobs soon.

Why Many Radio Technicians Make $30, $40, $50 a Week

Radio is already one of the country's large industries even though it is still young and growing. The arrival of Television, the use of Radio principles in industry, are but a few of many recent Radio developments. More than 28,000,000 homes have one or more Radios. There are more Radios than telephones. Every year millions of Radios get out of date and are replaced. Millions more need new tubes, repairs, etc. Over 5,000,000 auto Radios are in use and thousands more are being sold every day. In every branch Radio is offering more opportunities—opportunities for which I give you the required knowledge of Radio at home in your spare time. Yes, the few hundred $30, $40, $50 a week jobs of 20 years ago have grown to thousands.

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The day you enroll, in addition to my regular Course, I start sending you Extra Money Job Sheets which start showing you how to do actual Radio repair jobs. Throughout your Course, I send plans and directions which have helped many make from $200 to $500 a year in spare time while learning.

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I send you special Radio equipment, show you how to conduct experiments, build circuits illustrating important principles used in modern Radio and Television receivers, broadcasting station and loudspeaker installations. My 50-50 method of training gives you both printed instruction and actual work with Radio parts—makes learning at home interesting, fascinating, practical. I ALSO GIVE YOU A MODERN, PROFESSIONAL, ALL-WAVE RADIO SET SERVICING INSTRUMENT to help you make more money fixing Radio sets while learning and to equip you with a professional instrument for full time work after you graduate.

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Act today. Mail the coupon for Sample Lesson and my 64-page Book, "Rich Rewards in Radio." They point out Radio's spare time and full time opportunities and those coming in Television; tell about my course in Radio and Television; show letters from men I have trained telling what they are doing and earning. Read my money back agreement. Find out what Radio offers YOU! MAIL COUPON in an envelope, or paste on a postcard—NOW!

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I TRAINED THESE MEN

Service Manager for Four Stores

"I was working in a garage when I enrolled with N.R.I. In a few months I made enough to pay for the course three or four times. I am now Radio service manager for the M—— Furniture Co., for their four stores."—JAMES E. RYAN, 1543 Slade St., Fall River, Mass.

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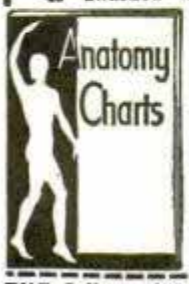

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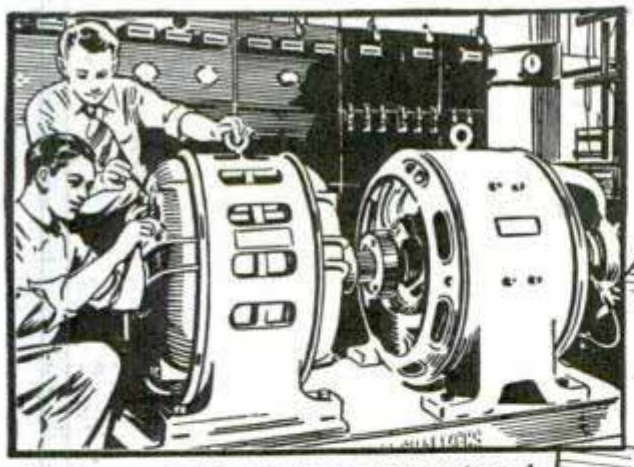
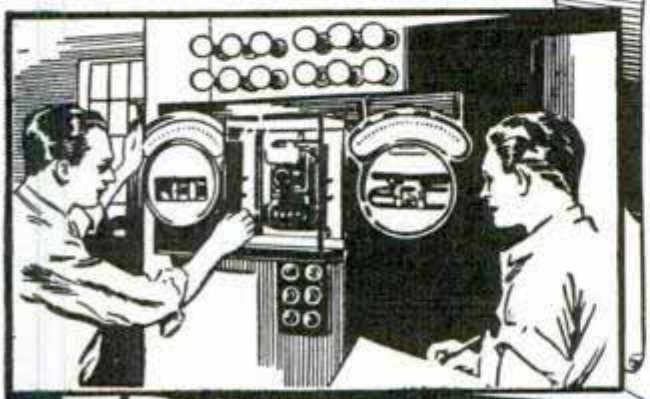
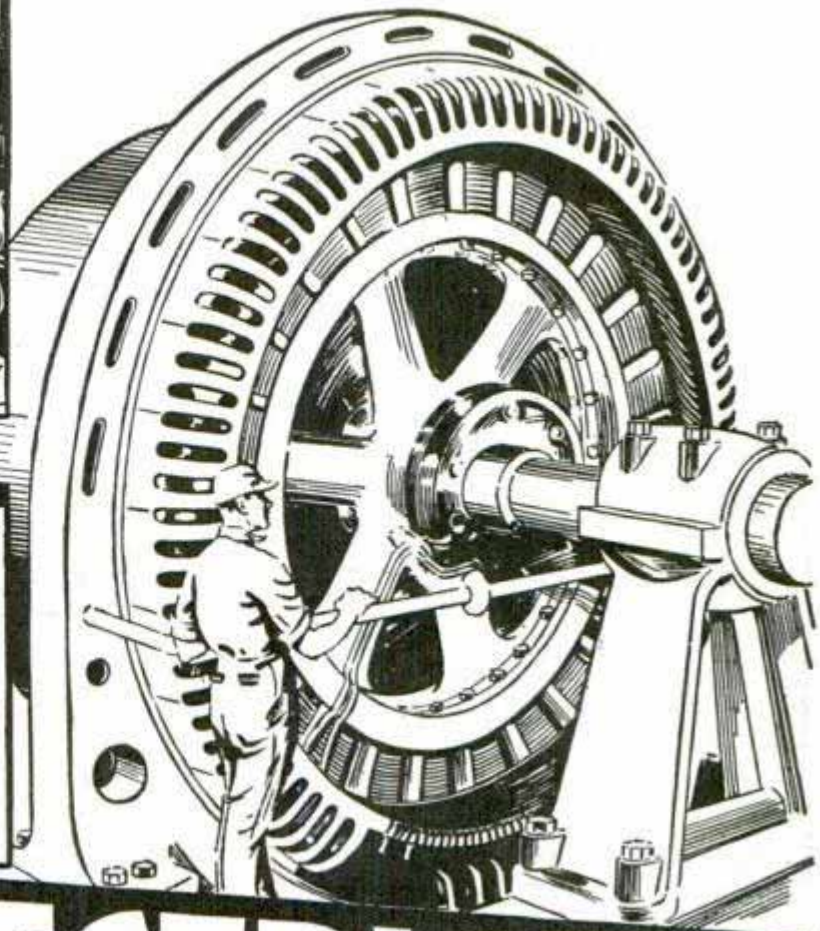


First you are told and shown what to do and how to do it. Then you do it yourself.





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I've filled my shops with many kinds of machinery and equipment for you to work on— similar to that which you will find on the job when you go out to work. You work on generators, motors and dynamos. You do house wiring, wind armatures and do actual work in many other branches of electricity. **You get 12 weeks of this practical shop training.** And to make your training still more complete, right now I'm including valuable instruction in Diesel, Electric Refrigeration and Air Conditioning at no extra tuition cost.

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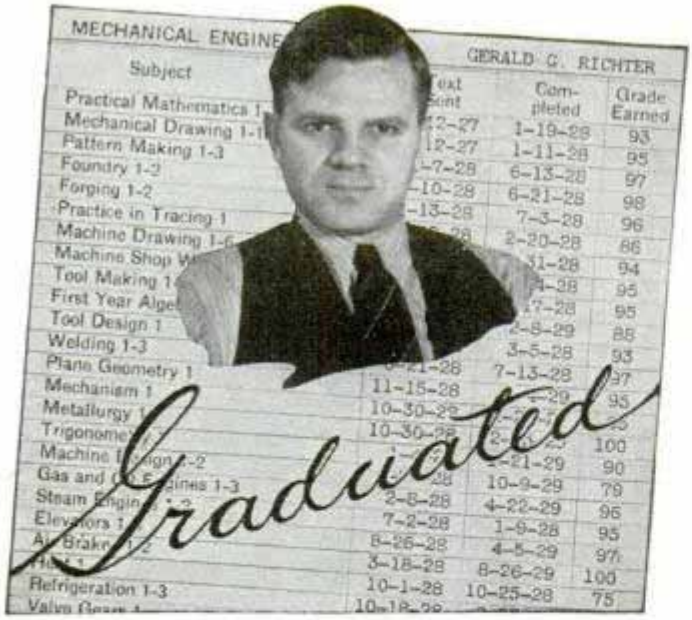

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Alice in Wonderland learned: *"You must run as fast as you can in order to stay where you are. To get anywhere, you must run TWICE that fast."*

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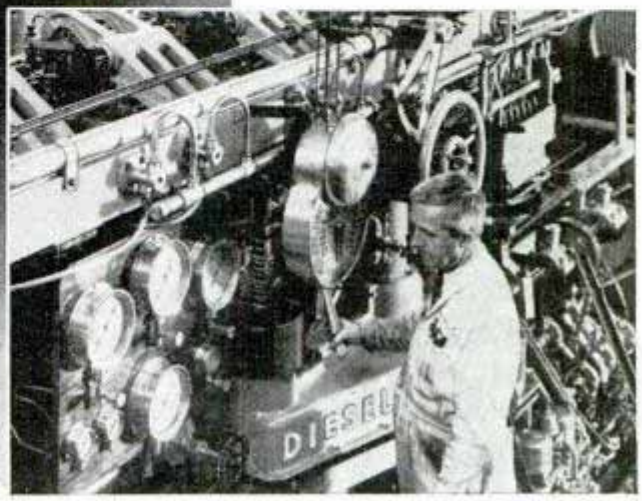

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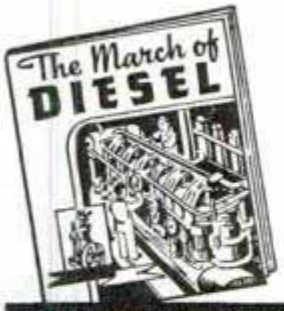

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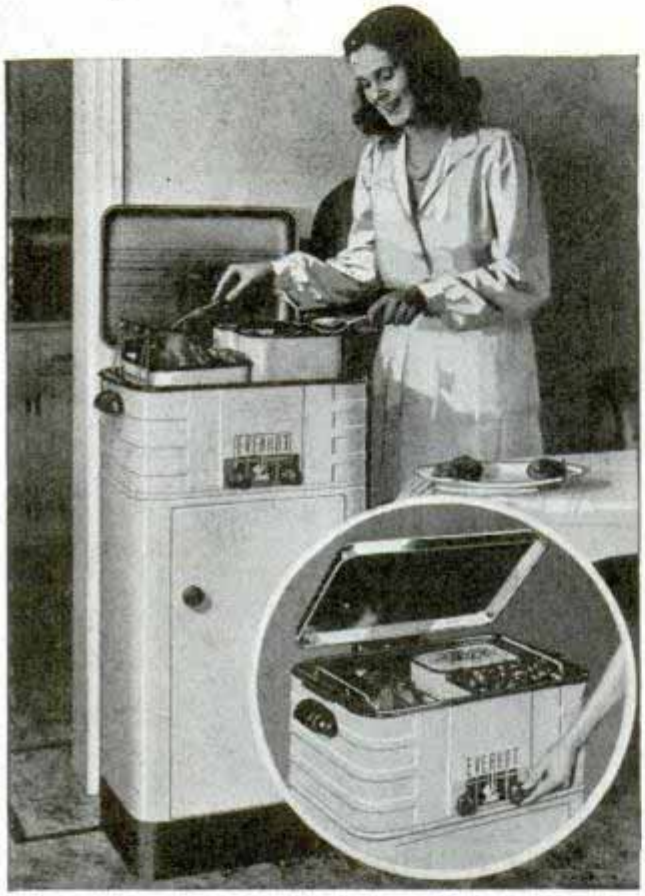
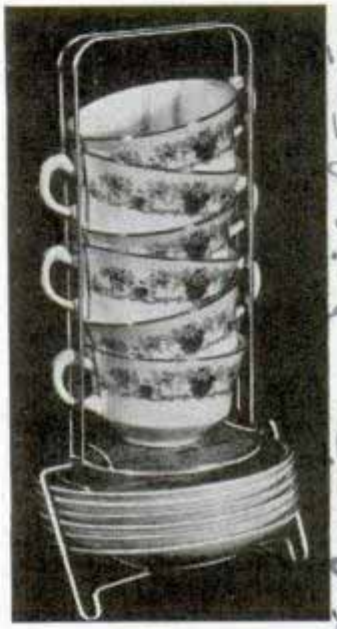


Danger of burning fingers in lifting the cover of one of the new range-roasters is avoided by a remote control. Turn a knob on the face of the stove and the lid rises. There is storage space in the lower part.

Bottle Top Pours Exact Portion

Here's a beverage dispenser that will serve the exact amount desired in each glass without spilling a drop. It is a plastic bottle top, adjustable so that nothing is lost in moving from one glass to the next, pouring a precise service each time it is tilted. It is easily cleaned simply by flushing with hot water, and is made of white Bakelite.

Cup Rack Occupies Small Space



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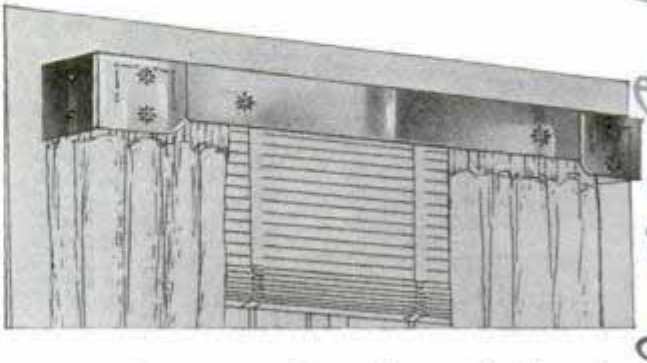

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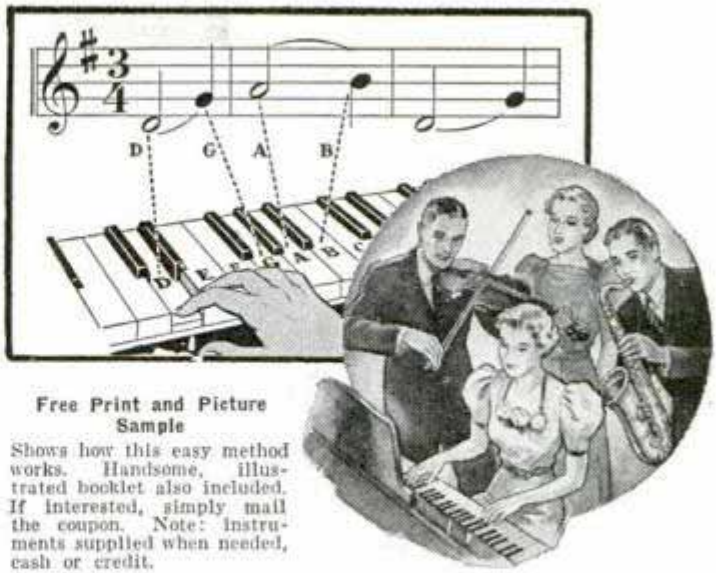

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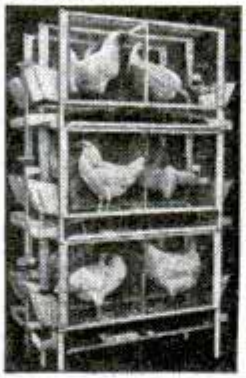

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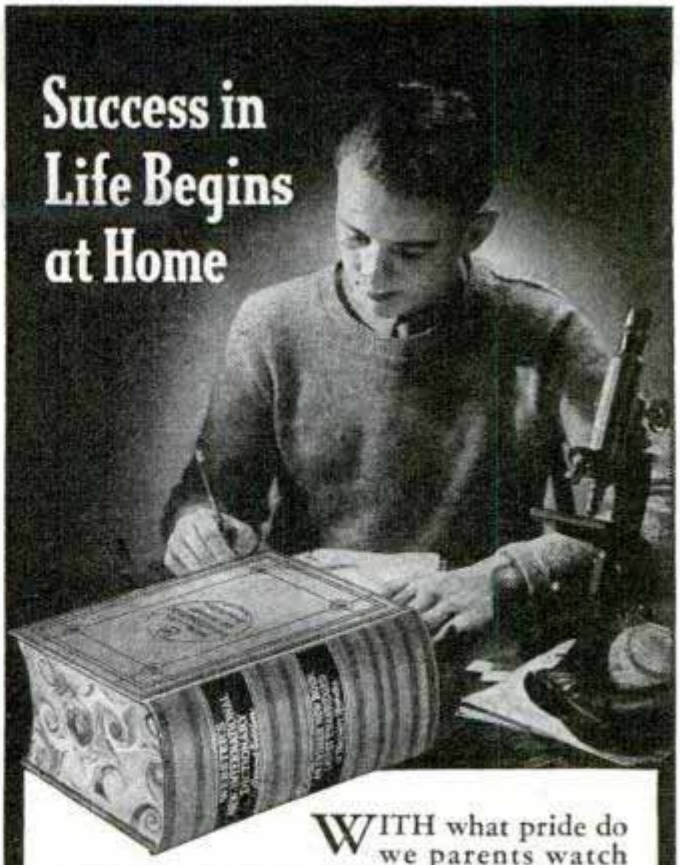

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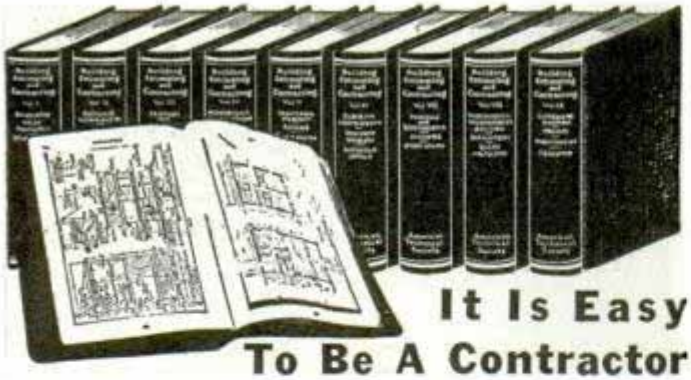

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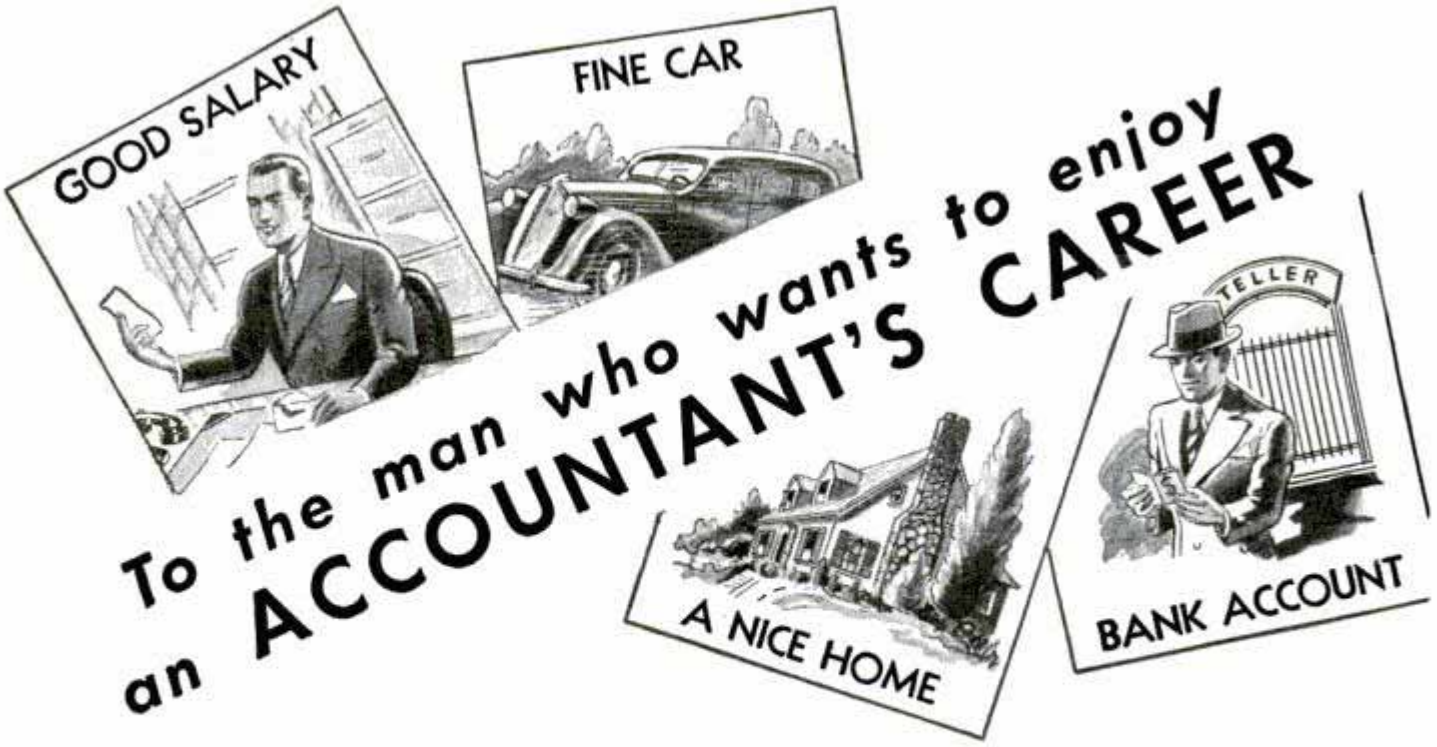

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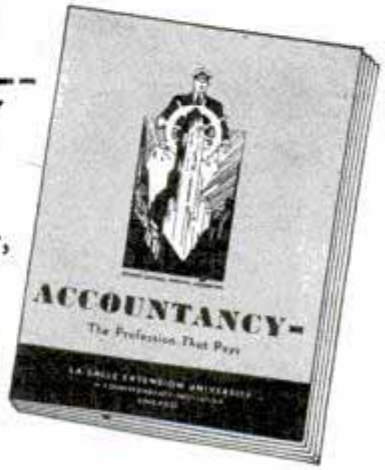

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SPECIAL—Five 5x7 enlargements 25c (coin) send negatives. Garrett Foto, Pittsburg, Kansas.

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ROLLS Fine grain developed, 8 rich, vivid, quality prints, two 5x7 masterpiece enlargements 25c. Rex Photo, Station A, Milwaukee, Wis.

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35MM. Rolls developed free. $3\frac{1}{4}$x$4\frac{1}{2}$ enlargements, 36 exposures $1.00. 18 exposures 60c—reprints 4c. Send roll and money today. Minipix, Dept. 54, P.O. Box 1144, Chicago.

ROLL Developed, 8 enlargements; or 8 prints and 2 enlargements, 25c. Enlarged reprints 4c. Artcraft, Box 3580A, Cleveland, Ohio.

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FINER Enlargements, 5x7 3 for 25c; 8x10 3 for 50c. Lee Photos, P.O. Box 2053, Chicago.

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BETTER Pictures, quicker service! Roll developed and 16 prints 25c. 20 reprints 25c. Hundred reprints $1.00. Mercury Studios, D-109 N. Dearborn, Chicago.

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START Home business making statuary, plaques, art goods, novelties, souvenirs, concrete pottery, garden furniture, artificial marble flooring, liquid marble. Make your own flexible molds. Amazing profits. Valuable folder free. Creative Publishers, (P4), Glencoe, Illinois.

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MONEY In "names!" Free instructions. Mailservice, 2231 McKinley, Berkeley, Calif.

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CASH Paid for insects. See Sinclair display advertisement on page 10A.

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RITE-AWAY Hand cleaner, powder, all mechanics buy—don't chap—it's great. 6 thirty cent cans and ten samples shipped prepaid one dollar. RiteAway Company, 310 West Burleigh, Milwaukee, Wisconsin.

CAN You really sell? What have you sold? Give full details. V. Reinhardt, 3710 Montrose, Chicago.

COSMETIC Creams. Save money. Buy from manufacturer. Excellent canvassing article. Sideline for established agents. Desiree Martin Laboratories ,525 51 Avenue, Long Island City, N. Y.

NEW 25c Household necessity costs 2c. Budget, 14006 Coit, Cleveland.

AGENTS Wanted, large profits. Address Lamont Company, Beacon, New York.

EX-O-LENE—Powerful mile increaser. Millions waiting. Distributors 35 gallon test 25c. Guaranteed. Thermo D-X Works, Peoria, Ill.

COLLEGE And high school seniors to take orders for graduation photograph name cards in their class. Attractive proposition. Write Universal Supply, Orange, Mass.

MONUMENTAL Agents, salesmen wanted. Many granites. Lettered. Guaranteed. Prepaid. Lowest manufacturer's prices. Mikelich Company, St. Cloud, Minnesota.

YOUR Own local shoe business. Free outfit starts you! Big advance commissions, bonus shoes. 208 different styles. Experience unnecessary. Tanners Shoes, 329 Boston, Mass.

WAFER Razor blades. Samples 25c. Graubard, 3434 Knox, New York.

AGENTS Wanted for sensational new electrical device — "Mend-Sox" — mends without darning. Featured in national magazines. Proven seller—big profits. Exclusive territories open. Write for details or send $2 for sample outfit including 30 patches, assorted colors. Everlast Manufacturing Company, Dept. M, 17 East 42nd Street, New York City.

AMAZING New invention. Indoor radio aerial. No wiring. Perfect on DC.-AC. short-wave set. Every home, store prospect. Big profit. Sample $1. Write for agency. H. Sterle, 815 Addison, Chicago.

MEN, Sell things men need and want. Blades, shave cream, etc. Send stamp. Hoffman Products Co., 57 Broad St., Albany, N. Y.

ALL Sales-people read "Mail Salesman" for successful results; profits; plans; ideas; methods. Sample copy dime and 3c stamp. Sidney, Pottsville, Penna.

FLUORESCENT Lighting fixtures: wholesale prices. Stamp brings illustrated bulletin. Braun Electric, 118 East 28th, New York.

NEW, Big, copyrighted personal employment record. Indispensable every worker under amended social security program. Fast 50c seller. Millions prospects. Sample 25c (silver). Hurry, be first. Rimer Company, Silver Springs, N. Y.

AMAZING Profits. Homes, stores, taverns, restaurants, hotels, churches, bingos, theatres, cemeteries—all your prospects. Plan copyrighted 1939. Send 25c (silver), self addressed stamped envelope. P.O. Box 81, Hudson City Station, Jersey City, N. J.

RESTAURANT Window signs, 1c each, samples free. Catalog 3c. Garden Press, Brooklyn, N. Y.

500% PROFIT. Gold and silver colored sign letters. Offices, stores. Large sizes 1c. Free samples. Modernistic, B-3000 Lincoln Ave., Chicago.

EARN $$ Easily. Sell Jem-Brite. Cleans all precious, semi-precious jewels and settings in 45 seconds. Harmless, non-poisonous, non-inflammable, pleasantly scented. Send 25c for sample. Satisfaction guaranteed. Amazing discovery. Jem-Brite, 78 Bowery, New York.

SUCCEED With your products. Make-sell them. Formulas. Processes. Accurate analyses. Catalog free. B. Thaxly Co., Washington, D. C.

EVERY Man and woman is a prospect! No experience or money required to represent world's largest shirt manufacturer selling direct to wearer. One year guarantee; half price offer; customized fit. Full line of sportswear including slacks and ensembles. Hosiery for men and women. Big advance cash commissions and 33% cash bonus writing easy orders, spare or full time. We deliver and collect. Write quick for free money-making sales outfit. Rosecliff-Quaker, 1239 Broadway, Dept. 465, New York.

AGENTS—Men's suits 84c, pants, 37c, top coats 62c, ladies' coats 52c, dresses 15c. Other big bargains. Catalog free. Roosevelt Mercantile, 566-SR Roosevelt, Chicago.

WINDOW Sign letters. Penny each, large sizes. New styles. Absolutely beautiful. Free samples. Atlas, 7941 Halsted, Chicago.

SELL Tricks, jokes and carded merchandise. Dixie Supply, Rosslyn, Virginia.

MANUFACTURE Specialties, hire agents yourself. Big money. Free literature. Gilbert Supply, 5-P West 24th, New York.

MONOGRAMMING Automobiles real money maker. Write for samples. International Co., Box 9360, Philadelphia, Pa.

AGENTS: Smash go prices! Santos coffee 12c lb. 4-oz. vanilla 8½c. Razor blades 10 for 8½c. 100 sticks chewing gum 12c. 150 other bargains. Premiums. Experience unnecessary. Carnation Company, PO, St. Louis, Mo.

GOOD Paying business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. N, Decatur, Ill.

AGENTS—300% Profit selling gold leaf letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

AGENTS — Opportunity make money; book containing 127 successful business plans; home-office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

AGENTS Make big profits on food products, bargain deals. Low wholesale prices. Rush name for trial outfit offer. Ho-Ro-Co, 2810-T Dodier, St. Louis, Mo.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 1105-1107 Broadway, New York.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

BIG Money applying initials on automobiles. Write for particulars and free samples. American Letter Company, Dept. 40, Dunellen, New Jersey.

REVOLUTIONARY Window cleaning tool. Good Housekeeping approval. Only ten $2.25 sales daily to housewives, factories, schools, stores will make you $350.00 monthly. Carter Products Corp., 900 Front Ave., Cleveland, Ohio.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

BIG Money applying initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for short order decalcomania name plates. "Ralco," 1305 Washington, Boston, Mass.

FREE Sample—Amazing cleaner; sells homes, taverns, everywhere. Big profit—fast repeater. Betco, 5007 Irving Park, Chicago.

BIG Money taking orders; shirts, ties, hosiery, underwear, pants, jackets, sweaters, uniforms, etc. Sales equipment free! Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

HIGH-GRADE SALESMEN

SALESMEN—Amazing new glass cleaner sells fast, repeats. Demonstrations reap big profits. Needed everywhere. Universal Utility, Box 600, Gloversville, N. Y.

SALESMEN, Distributors: 200 items, brushes, mops, marvelous magnetic brush—excels vacuum cleaner. Big profits. Neway Brush Co., Hartford, Conn.

ADVERTISING Book matches offer liberal earnings—full, spare time. Experience unnecessary. Factory direct. Low prices for fine quality, quick deliveries, help get orders; faster repeats. All business firms prospects. Free outfit, instructions. American Match & Printing Co., Dept. 64, 4822 South Trumbull Ave., Chicago.

ADVERTISING Book matches — Sell union label book matches. Fastest selling line in America. Large sales producing kit, sample matches, complete cut catalog, eight color combinations make selling easy. Commission in advance. Superior Match Co., 7530 Greenwood, Dept. M-4, Chicago.

SALESMEN: America's finest sideline, 40% commission daily. 725 fast selling repeat items. Every business uses and must buy. No investment now or ever. Sales portfolio free. Willens, 2130 Gladys, Dept. VF, Chicago.

WANTED: Permanent representative for Hoover uniforms—waitresses, doctors, nurses. Slack ensembles, aprons, frocks. Smartest styles. Finest quality. Exceptional commissions. Line free. Hoover, 251 W. 19th St., Dept. CK-10C, New York City.

PLACED On free trial to customers. Sells itself. Tremendous sales possibilities! Revolutionary inter-communication system. Talk to one or as many as ten people, even 2000 feet away. Loud speaking, back and forth, private conversation. Operates like radio—one electric connection. No servicing or installing problems. Fully guaranteed. Technical experience unnecessary. Easy two-minute demonstration. Thousands prospects — factories, offices, lumber yards, garages, parking lots, restaurants, etc. Accounts receivable carried by factory. Present low price opens big new field. Men earning high as $100-$150 week. Protected territory available. Free demonstrator offer. Inter-Communication System of America, 2440 Lincoln Ave., Dept. 305, Chicago.

SELL Printing at cut prices. 2,000 business cards $1.50; 1,000 envelopes or statements, etc. $1.75; 25 printed sales books $1.50; 1,000 process embossed cards $1.50; 2,000 two-color labels, free holder $1.50; 2,500 printed handbills $1.75. One-third comm. Free outfit. Bargain Prtg. Co., 189-F W. Madison, Chicago.

BLADES—Big profits. Best quality. Factory prices. Postpaid. Ace Blades, Buffalo, N. Y.

SALESMAN—Retail clothing store experience. We will assist good man to establish own local business in fine custom-tailoring. Confidential. Write P. H. Davis Tailors, Dept. P.M., Cincinnati, Ohio.

SELL Gas stations. First National Shoes, 183 Essex St., Boston, Mass.

COMPLETE Line everyday business necessities—Over 2000 items at big money saving prices. Experience unnecessary. Samples free. Commissions advanced daily. Northwestern, 625-AG Jackson, Chicago.

A REAL Future for you with Red Comet fire control products. Low prices. Proved seven years. Splendid sales outfit free. Some good territory open. Exclusive. Write quick. 704 Red Comet Building, Littleton, Colorado.

IS Your job a "blind alley?" There's a real future in your own wholesale business. Profits can run into really big money. Start with little as $2.50. Handle steady year 'round route of local stores. Collect, deliver orders for 200 nationally advertised 5c-10c counter products. Use home as headquarters. Chance to operate one of our Silver Fleet service trucks. No experience necessary. Facts free. World's Products Co., Dept. 10-R, Spencer, Ind.

SELL Stores chocolated Sur-Lax, big free deal. Burton Laboratories, Cincinnati, Ohio.

BIG Daily profits, extra cash bonuses. Represent large manufacturer. Show complete line tailored shirts, neckwear, hosiery, underwear direct to wearer. Experience unnecessary. Part or full time. Handsome outfit free. Write. Tell us something about yourself. Packard Corporation, Dept. F462, Terre Haute, Ind.

DISTRIBUTORS Get started in your own linen and shirt supply business, for information write to Uniform Outlet Co., Box 53, Highland Park, Ill.

SELL New plastic drivers license holder with key chain. Every auto owner must have one. Prospects, auto distributors, gas stations, drug, hardware, novelty stores. Can use few salesmen who can show sales record to chain stores, jobbers, advertising and premium users. Sample 15c, dozen 75c, gross $7.20, prepaid. 10 other fast sellers. National Plastic Sales, 1657 Monadnock Bldg., Chicago.

ONLY Two sales per day makes over $1200.00 monthly profits. Auto tools. Every mechanic a prospect. 95% virgin. $50.00 sales makes $36.00 profits. New. Proven. Protected territory to producers. Year around demand. Mesco, Beaver City, Neb.

ADVERTISING Salesmen—Rap-A-Pak—Permanent advertising specialty advertises merchants business on cigarette packages; protects pack from crushing; big cash in advance on every order; full repeat commissions. Sells everywhere. Free samples, saleskit. Rap-A-Pak, 215-223 E. Cullerton, Chicago.

"NO-KOFF" Filtered cigarette holder, retailing for only 10c, has more features than $1.00 holders. Compelling, counter display card, placed on any merchants' counter, empties fast, repeats in hurry. Send 25c for three assorted color samples and selling proposition. Profits over 100%. Milton Products, Inc., 1209 W. North Ave., Baltimore, Md.

EXCELLENT Opportunity selling our complete line of brushes, largest commissions. Write for sales plan. Wire Grip Sanitary Brush Company, 2300 5th Ave., New York.

GEM Book matches in new flashy colors going big with stores, taverns, political candidates. Good comm. Free outfit. Gem Match, 82-A West Washington, Chicago.

NEW Social security requirements make Easyway Systems fast, profitable seller to employers. Easyway, Box 816, Birmingham, Alabama.

NEW Type aluminum cylinder head remover for V8's and all other cars—requires only few moments—garages—repair shops buy readily. Real labor saver. Easily carried in pocket. Salesmen banking money. Avoid delay send $6.50 for set. Shelburne Mfg. Co., Hannibal, Mo.

NO-CO-RO Insures automobile batteries against corrosion. Place display cards—service, filling stations; ten pays $9.50. No-Co-Ro Company, Oakland, California.

NEW Scientific wood block stamp pad. No felt, no cloth; no uneven impressions. Five brilliant colors. Unaffected by humidity. Fast seller; good repeater; big profits. Every office needs one to dozen. Retails 75c. Costs $5.40 dozen; 6 dozen $27.00. Sample and sales plan 45c. Sheridan, 15 East 26th St., New York.

SCREW Holding screwdriver. Indestructible. Sensational seller. Mechanics, electricians, garages, shops. Big profits. Territories going fast. Sample outfit $4.00. Four sizes. Detroit Carbide Tools, Box 64, Roosevelt Station, Detroit.

AMAZING Patented screw-holding screw drivers! Factories, stores buy quantities; big profits; fast sellers, quick repeats. Free trial! Toolco, 6019 Journal Bldg., Boston, Mass.

BIG Commissions—selling to stores celluloid pricing tickets, metal shelf moulding. To restaurants, menu covers, signs. P. Pricing Press, 124 White St., New York.

NEW Invention tremendous weekly repeats, over 100 million are used yearly. Prevents 90% electrical troubles. Foolproof 50c postpaid. Distributors wanted. Pontus Manufacturing, 978 Broadway, East Providence, R. I.

CALENDARS, All sizes—Orders are being placed now for 1941 calendars, advertising fans and novelties. Free samples—get started now and book those early orders. Fleming Calendar Co. 6543 Cottage Grove, Chicago.

NEW Specialty—Sells every business and professional man. Four $15 sales daily pay $280 weekly. Farrell cleared over $1,000.00 monthly. Write F. E. Armstrong, President, Dept. PM, Mobile, Ala.

EDUCATIONAL AND INSTRUCTION

INVENTIVE Minded. Proved ways to independence explained for stamp. K-Higbee, Cantil, Calif.

DIESEL Engine cardboard instruction model. $1.00. Herber, 1360 Hicks, New York City.

HOME Study for degree. Psychology, Metaphysics, Mental Science, Bible, Philosophy. Free prospectus. College of Universal Truth, 20-B East Jackson, Chicago.

BOOKS On advertising, art, color, photography, engraving, printing, offset, silk screen, journalism, sales, management, correspondence, etc. Trade magazines. Discounts. List free. Commercial Engraving Publishing Company, 34C North Ritter Avenue, Indianapolis, Indiana.

AIR Conditioning—Electric refrigeration. Rapid growth creates big demand for trained men. Earn up to $35-$50 weekly. Write for free facts. Utilities Engineering Institute, 404 North Wells, Dept. 104, Chicago.

GOOD Pay, steady job. Learn meat cutting easily—quickly. Essential business. People must eat. Openings for trained men everywhere. Intensive short course makes you fully qualified union meat cutter in six weeks. Free catalog. We have no salesmen. National School of Meat Cutting, Dept. U-5, Toledo, Ohio.

SEE Our ad under "Business Opportunities." Cole Associates, Syracuse, N. Y.

BE Expert in arithmetic. Simplified method. 50c. Coin or stamps. Arith-Magic, Dept. V, Maywood, Ill.

AMAZE With extraordinary memory! Make learning easy! Remember names, dates, facts, ideas, with incredible ease. "Super Memory" tells how. Details free. Write. Info Company, Box 1122, Chicago.

MEN—Women. Get U. S. government jobs. Commence $105 to $175 month. Short hours. Prepare immediately for next examinations. No experience usually necessary. Common education usually sufficient. Full particulars and list positions free. Write today sure. Franklin Institute, Dept. C3, Rochester, N. Y.

ELECTRIC Welding pays good money. Jobs everywhere. Our short course trains you. Write for information. Welding Company, 4100 Paul Street, Philadelphia, Penna.

WATCH Repairing is steady profitable work. Experts usually in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Co., D-2001 Manhattan Building, Chicago.

CLAIM Adjusting. Excellent pay. Investigate tragic accidents, fires; outwit fraudulent claimants. Burns School, 311 Moreewood, Pittsburgh, Penna.

FIVE Long Days. I claim there are secrets of success, prosperity and health, hidden in the Bible. Christ taught them, but church doctrine has overlooked them. Thousands have studied these secrets and prospered. Send $1.00 for new enlarged booklet, "The Secret Place' and three valuable manuscripts on "Divine Health" given free with each order. Study Five Long Days, if not satisfied, mail back and money returned. Will also mail to you C.O.D. Send card or money order to Dr. J. Smith, D.D., Dept. MP, Box 71, Stoneham, Mass.

LEARN Arc welding. It's easy—get big pay jobs—complete individual instruction at bare cost of materials used. Write for details. The Arc Welding School, Box M-4405, Troy, Ohio.

BECOME Lightning calculator. New "Mental Multiplication" teaches you. Paper, machines unnecessary. "Mental Multiplication," 25 page book, sent postpaid for 25c. Charles Lipkin, 249g West 34th, New York.

LEARN Air conditioning, refrigeration in our Hollywood shops. Pay 75% of cost after completing your training. Free catalog. Welfare Department, 1141 North Highland, Los Angeles.

BETTER Positions? 22"x17" "Successful Chart" helps! 50c postpaid. Altiery, 1300 South 9th, Philadelphia, Penna.

BE A chemical growing expert. Become advisor for large estates, commercial growers, nurseries installing plants everywhere. Raise and sell your own vegetables to leading restaurants, stores, at premium prices. Convert unprofitable greenhouses into moneymaking concerns. Greatest opportunity available for large-salaried jobs. Chemi-Grow, Ltd., 408 Sunset Blvd., Los Angeles.

ENGINEER And fireman's license, assistance given for examination, questions and answers. Information on request. 10c to pay cost. Schaehner, 229 Rancocas Ave., Riverside, New Jersey.

LEARN Law quickly! Stream line, home study law course directed by an ex-judge of 25 years legal experience. Unessentials eliminated. Walter G. Walker, Attorney, Daytona Beach, Florida.

LINOTYPE Course $200. Empire School, 206 E. 19th St., New York.

LEARN Air conditioning, refrigeration. Practical work in our Hollywood shops. Free catalog. Chief Engineer, 1141 North Highland, Los Angeles.

CLINICAL Laboratory technique taught in your own home at actual cost. Bulletin free. Imperial Technical Institute, Box 198, Elkhart, Indiana.

BLUEPRINT Reading taught by mail. Write Blueprint Reading Institute, Dept. A, Box 5662 Metropolitan Sta., Los Angeles.

SUCCESSFUL Stenographers, typists, bookkeepers, accountants, secretaries, social secretaries trained in home study department. Write for folder showing graduates' success. Give age, occupation, course preferred. Low tuition. Perry Schools, Brunswick, Georgia.

LEARN Beautiful penmanship—Inexpensive course. Hotell School, 36 Paulding, Tarrytown, New York.

NEWSPAPER Jobs—Learn practical reporting, freelance journalism from experienced editors, by mail. The Millers, 10, Bakersfield, California.

BIG Pay trades you can learn in a few weeks. Decorating, paperhanging, graining, marbling, card writing. Enroll now. Booklet free. Chicago Painting School, 102 West Lake Street, Chicago, Illinois.

HOW To secure a gov't job in the classified civil service. Railway postal clerk, $1900 a year. Postal clerk, city mail carrier, $1700. Other jobs, $1260 to $2100. Our method helps you pass exams. Men-women, age 18 to 50. Send for free book. Patterson School, 8C Mercantile Bldg., Rochester, N. Y.

MASSAGE, Hydrotherapy, dietetics, drugless therapeutics, chiropody, taught by mail. Evans Correspondence School, Montgomery, Ala.

LEARN Auto mechanics, body, repairing, welding electricity, refrigeration, Diesel. Stevinson's, 2008A Main, Kansas City, Mo.

TELEGRAPHY Taught thoroughly. Railroad retirement act creating opportunities for new operators. Expenses low. Catalog free. Dodge's Institute, Hiatt Ave., Valparaiso, Ind.

SECRET Investigation. Experience unnecessary. Detective particulars free. George Wagner, M-2640 Broadway, N. Y.

PLAYS, STORIES, MANUSCRIPTS

FREE Test for writers! Send for our free market propensity test. Designed to show for which of 2,500 paying markets for free-lance writing you are best fitted. Write today. Comfort Writer's Service, Dept. 430, St. Louis, Mo.

WRITERS! Cash in on ability. Journalists' Guild helps you. Annual dues, $1. Particulars free. Guild, 1727-47 Lee, Evanston, Illinois.

MANUSCRIPTS Typed, 5 cents 100 words; carbon copies 5 cents 300 words; return postage paid. Mark Zeiler, 2848 Wise Road, Overland, Mo.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

SECRETS Of cartooning. Market guide 10c. Cartoon Studios, LaCrosse, Wis.

LEARN Cartooning for profit. Leon Gray School, Box 1901, Dallas, Texas.

CHALK Talks. Laugh producing program, $1.00. Catalog 10c. Balda, the Cartoonist, Oshkosh, Wisconsin.

DRAW Instantly without training with the Mur-O-Graph. Make money at home drawing for advertisers. Draw portraits, showcards, etc. Complete instructions with each instrument. Guaranteed. Special introductory offer $2.00 prepaid. Mur-O-Graph, 801 North Marsalis, Dallas, Texas.

DRAW For profit. Simple, easy spare time lessons at spare change cost. Send 25c for first lesson. Toledo School of Art, 801 Jefferson Ave., Toledo, Ohio.

PEN And ink drawings. Let us draw your advertising and catalogue illustrations, from photos, copies or objects. Best work and fair prices. Heraldic Studios, 1914P Oakdale Avenue, Chicago, Ill.

AMATEUR Cartoonists. Earn cash at home, copying advertising cartoons. Ad-Service, Argyle, Wis.

ART Magazine including directory art books—free! Send 10c postage. Art Headquarters, Doty Street, Madison, Wisconsin.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

LEARN Advertising at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 3601 Michigan Avenue, Dept. 3439, Chicago.

ADVERTISE Profitably: $15 reaches 5,000,000 Sunday newspaper readers with 24-word ad. Newspaper, magazine, mailing-list ratebook, free. Chicago Advertising Agency, 20-PA West Jackson, Chicago.

ADVERTISE: 24 Words, 149 newspapers $6.50. Lists free. Advertising Bureau, 4515-C Cottage Grove, Chicago.

INCH: 100 Magazines $2.00. Gibbs, 502 W. 151, New York.

MAILING Lists of householders St. Louis area, 98 per cent accurate. $2.00 1,000; $5.00, 3,000. Mark Zeiler, 2848 Wise Road, Overland, Mo.

MAIL Order—big profits. What have you? Esco-PM, Kansas City, Mo.

ADVERTISING Placed all magazines, newspapers, radio. Lowest rates. Free service. 54 page rate book free. Baker Advertising Agency, A-189 West Madison, Chicago. Successors to Ankrum. Established 28 years.

FREE—New Advertisers Rate Guide, 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency, 140 S. Dearborn, Chicago.

BUSINESS SERVICE

NEW York City, mail address; business, personal; reforwarded; $2 monthly. Wiesen, 151-M West 40th.

PRINTING At lowest prices. All kinds. Commercial work. Samples. Modern Press, 6 Forest Place, Fredonia, N. Y.

TYPE Anything, manuscripts 50c thousand words. Bond paper. J. Smith, 9421-80 Street, Ozone Park, L. I.

CHICAGO (Downtown) mail address $1 monthly. Your mail reforwarded daily. General Business, 56 West Washington; (established 1919.)

LET Stanley's do your typing. Estimates Free. No. 706 - 424 So. Broadway, Los Angeles.

PERSONAL And business mail received and forwarded. $2.00 monthly. Dunn Mail System, Box 42, 216 West 69th St., New York, N. Y.

WASHINGTON, D. C., mail address and reforwarding service. Hawkins, 817 Fourteenth.

127 MONEY Making plans for home folks. Particulars free. Guardian, 971 College, Toronto, Canada.

RUBBER STAMPS AND OFFICE SUPPLIES

ORIGINAL. Cushion mounted. Two lines, 25c; three 35c; signatures $1.50. F. E. Slocum, 814 Bradley, Peoria, Illinois.

CUSHIONED. 2 Lines 25c, 3—35c. Ours are better! Adcrafts, Lacrosse, Wis.

"RUBBER Engravings." Make signatures, pictures. Complete outfit $1.50. Sent postpaid. Janes Service, Quincy, Ill.

RUBBER Stamps, make them yourself. Professional method, inexpensive, process directions $1.00. Alta, 472 South Charity, Bethel, Ohio.

CUSHIONED 3 Lines, 35c. Stamp-Works, Box 402, Youngstown, Ohio.

EXTRA Large illustrated catalog 10 cents. Royal Ford, Bristol, Conn.

2 LINES 25c, 3—35c, Cushioned. Stamp Works, Centerport, N. Y.

2 LINES 25c, 3 Lines 35c. Stamp Works, Auburn, Nebr.

TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

NEW Remington portable $24.50. Free trial. Easy payments. Karl Ruppenthal, Lawrence, Kansas.

TYPEWRITERS, Adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

NEW $3.75 Automatic adding machine. Fully guaranteed. Bassett, Box 302-A, Altadena, California.

INCREASE Business now. "Excellograph" Rotary Stencil Printer reprints thousands everything you typewrite, handwrite, draw or trace. Colors. $19.75 to $44. Terms. Illustrated literature free to business or professional men. Pittsburgh Typewriter Supply, Department K-2, Pittsburgh, Penna.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

500 6x9 CIRCULARS: 300 Words—$1.00. Lincoln Sales, Box 32, Irwin, Penna.

$1.00 EACH, 250 Letterheads, envelopes, statements. Samples. Allen, Fort Edward, N. Y.

2,500 CIRCULARS, 3x6, 125 Words $1.00. SeKay, 1407 W. Cherry, Milwaukee, Wis.

500 STICKERS. Four lines, 2½x⅝. 25c. Outstanding, Gazette, Spickard, Missouri.

$1.85 POSTPAID! 500 6¾ Envelopes. Stanley Press, Drawer 1500, St. Augustine, Florida.

SUNRISE Press, 133 George Street, Brooklyn, N. Y. 1000 letterheads, envelopes, statements $2.50.

QUALITY Printing. Samples free. Pine Hill Printery, Freeman, S. Dak.

1000 BUSINESS Cards $1.00. Vellum, free cuts. Dixie Business Card Co., PM189 Jefferson, Memphis, Tenn.

6x9 CIRCULARS $1.00 Thousand, quantities. Stationery, folders, booklets, catalogs, cards, labels—all printing—lowest prices. Elegant samples. Goodprint, Harrisonburg, Va.

8½x11 LETTERHEADS, 20 lb. bond, 250 for $1.10; size 6¾ envelopes, 250 for $1.10, neatly printed, with your name and address, postpaid. Normandy Press, 3310 Tudor Street, Philadelphia, Penna.

ATLANTIC 8½x11 Letterheads, Atlantic 6¾ envelopes, 200 of both $1.50, postpaid. Samples. Atlantic, Box 653-H, Rock Hill, S. C.

BUSINESS Cards, 2000—$2. Startlingly superior. Empire Card Co., 7 West 44th, New York.

ADVERTISING Cuts, circulars, folders, designed, supplied. Distinctive; no "standardized hash." Samples. Lithotype, P.O. Box 20, Ozone Park, N. Y.

$1.00 POSTPAID—125 8½x11 Twenty pound bond letterheads and 125 6¾ envelopes. Benneville, 907 West Roosevelt, Philadelphia.

$1.00 EACH—250 Letterheads, statements, envelopes, noteheads. Dahlke, Grand Island, Nebr.

500, TWO-COLOR Stickers 50c. Labels, Samples. Cott's, Spickard, Missouri.

WEST Only—1000 business cards $1.75, 1000 letterheads $2.50, 1000 6¾ envelopes $2.75. Prepaid. Lion Press, 110 E. Leffelle St., Salem, Oregon.

FREE Samples, fine business printing. Write, H. Cotter, 2457 Seyburn, Detroit.

BUSINESS Cards, $1.00, 1000; statements, memo heads, envelopes, postals, $1.75, 1000. Cuts cast free. Stoddard's, Delmar, Iowa.

MULTIGRAPHED Letters, exact duplicate typewriting, 500; $2.50. Letterheads, envelopes, 125 each! $1.00. Paramount Press, Hudson, N. Y.

THOUSAND: Two color shipping labels, 4x2½—$1.75; large envelopes—$2.95; 3x6 circulars—$1.50; advertising cards—$2.45. Quantities much cheaper. Okayprint, Martins Ferry, Ohio. Samples.

HAMMERMILL Letterheads, any color paper, ink; 300 8½x11, $1.48 postpaid. 30 styles type. Free particulars. Woodruff's, 217A Lewis, Duluth, Minn.

5000 3½x5½ THROWAWAYS $6.00, 5000 5½x8½ Circulars $6.00. Free postage. I. R. Printing, 1910 Arthur Ave., New York, N. Y.

125 8½x11 WATERMARKED Bond letterheads, 125 6¾ envelopes, printed, postpaid $1.00. McConnell's, 411 N. Gilbert St., Danville, Illinois.

MULTIGRAPHED Letters:—Guaranteed like typewritten! 300—$1.50; 1000—$2.25; (300 words). General Multigraphing, 108 North Dearborn, Chicago.

STICKERS—500 Two colors 50c. Labels. Catalog. Printrite, Biltmore, N. C.

1000 BUSINESS Cards postpaid $1.00. Luke Sharpe, 836 Crocker, Los Angeles, Calif.

1000 NEAT Business cards $1.00 postpaid. Taft Co., Box 5366, Chicago.

PRINTED Stationery—200 8½x11 bond letterheads, 200 6¾ envelopes, both $1.00 postpaid. Franklin Printery, 2932 Pershing, Chicago.

DISTINCTIVE Letterheads, fine printing, friendly service. Forest, 202 Ashland, River Forest, Illinois.

1000 PRINTED Adcards 3½x5½, $2.39. Samples free. Comstock, Charlestown, N. H.

500 LETTERHEADS, Envelopes, statements or billheads $1.00. 5000 $7.50. Carter, Box 52, Orange, Calif.

BETTER Grade printing, free trade illustrations. Reasonable. Economic Press, Leonia, N. J.

50 SHEETS, 20 Envelopes, 25c postpaid. Western Stationery, Topeka, Kansas.

500 ¾x2¼ FOUR Line gummed stickers, 25c. Moritz Printery, Saginaw, Mich.

PRINTING OUTFITS AND SUPPLIES

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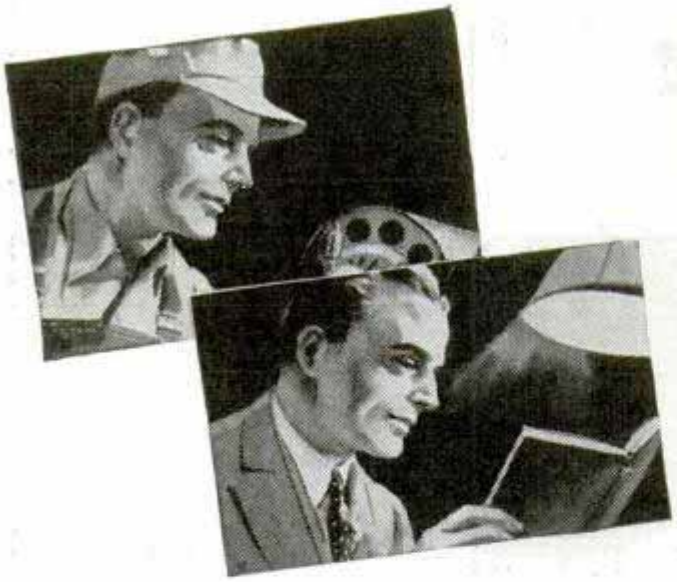

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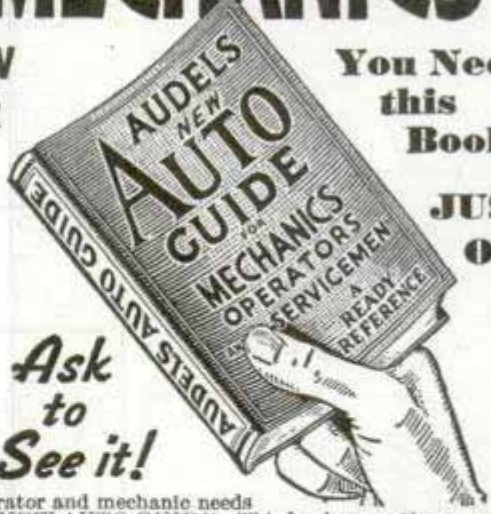

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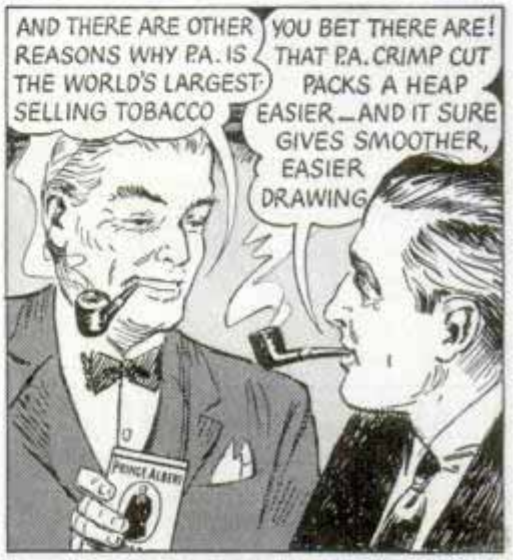
CHUBBINS, DID YOU EVER HEAR OF A BALLROOM 500 FEET UNDERGROUND?
OH, DADDY, YOU'RE FOOLING
I'LL SHOW YOU. THIS 'WONDERLAND CAVE' IS ONE OF THE SHOW PLACES OF ARKANSAS. LET'S GO IN
JUST IMAGINE — MUSIC AND DANCING WAY DOWN IN THE EARTH — AND ISN'T IT COOL HERE, DAD?
PARDON ME, SIR — IS IT ALWAYS THIS COOL DOWN HERE?
YOU BET! SIXTY-TWO DEGREES, DAY IN, DAY OUT. THIS CAVE IS NATURALLY COOL — AND ALWAYS THE SAME

I SEE YOU'RE A MAN WHO APPRECIATES COOLNESS IN HIS SMOKING, TOO
WELL, WHEN I HEARD HOW MUCH COOLER PRINCE ALBERT SMOKES, I DIDN'T LOSE A MINUTE. A COOL SMOKE SURE IS MILDER AND TASTIER, TOO

IN RECENT LABORATORY "SMOKING BOWL" TESTS, *PRINCE ALBERT* BURNED

86 DEGREES COOLER

THAN THE AVERAGE OF THE 30 OTHER OF THE LARGEST-SELLING BRANDS TESTED — *COOLEST OF ALL!*


AND THERE ARE OTHER REASONS WHY P.A. IS THE WORLD'S LARGEST-SELLING TOBACCO
YOU BET THERE ARE! THAT P.A. CRIMP CUT PACKS A HEAP EASIER — AND IT SURE GIVES SMOOTHER, EASIER DRAWING
PRINCE ALBERT

HERE'S YOUR PASS TO THE SMOKE-JOY CIRCLE

TONGUES PRAISE PRINCE ALBERT FOR COOLER SMOKING. THERE'S NO EXCESS HEAT TO STEP UP BITE AND FLATTEN FLAVOR
NOW I CAN ROLL SMOKES WITH THE EXPERTS — FAST, SLICK, AND FAT. THAT P.A. CRIMP CUT IS A PRIZE FOR ANY ROLL-YOUR-OWNER TOO
MILDER SMOKING, RICHER TASTE, EASY PACKING AND DRAWING, BETTER CAKING — I GET 'EM ALL WITH PRINCE ALBERT!

50 pipefuls of fragrant tobacco in every handy tin of Prince Albert

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THE NATIONAL JOY SMOKE

Popular Mechanics Magazine
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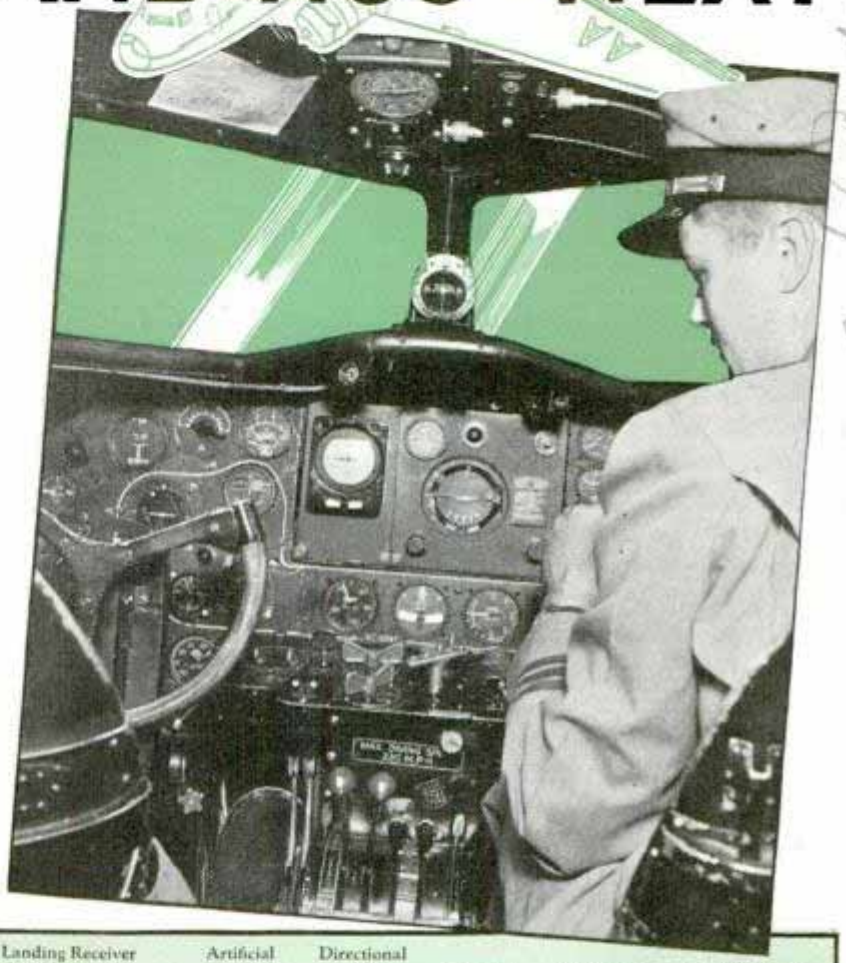
WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 73 APRIL, 1940 No. 4

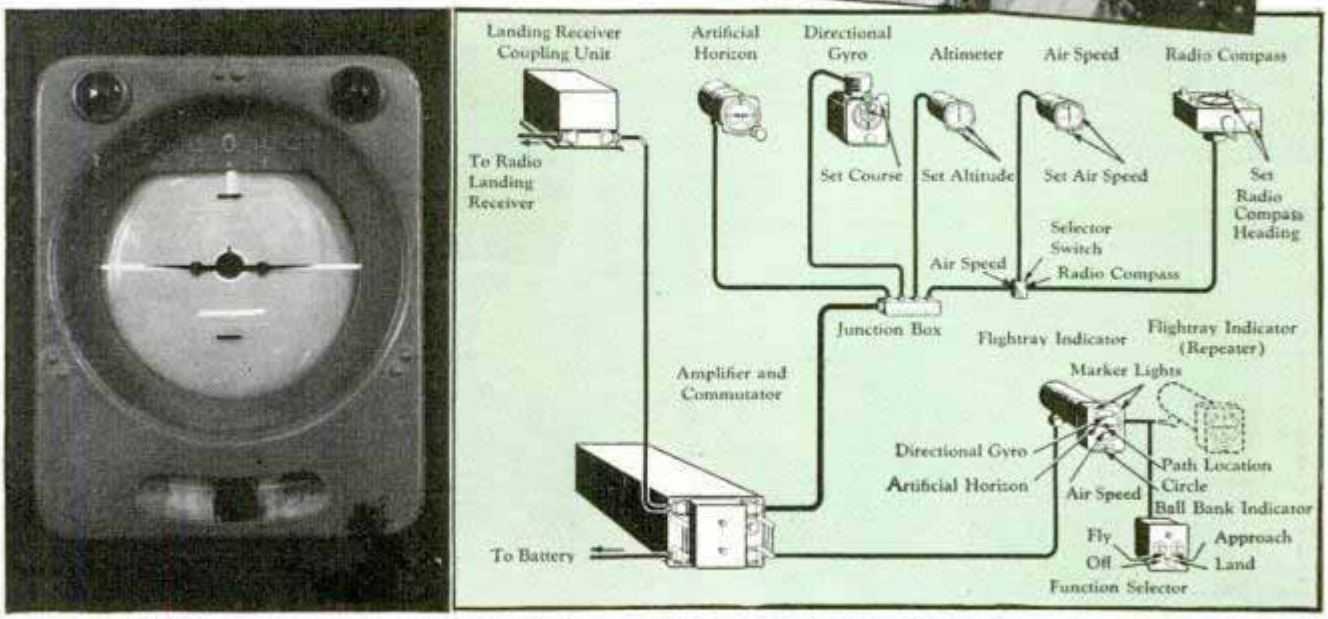
BLIND LANDINGS NEXT

By Julian Leggett

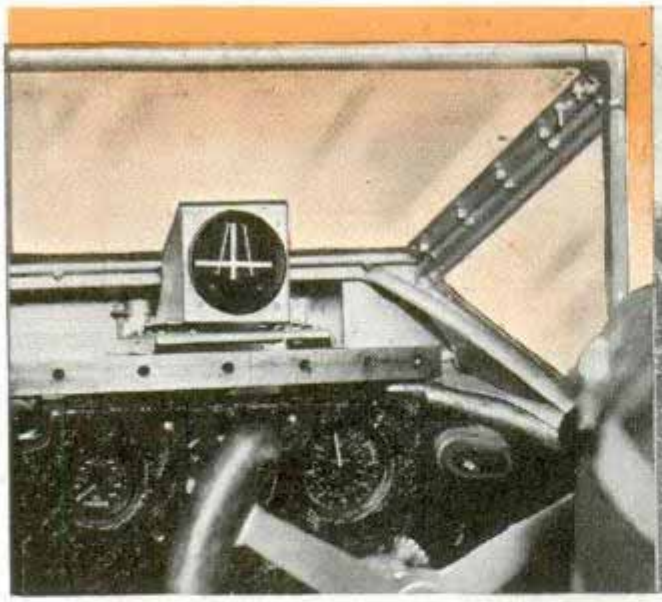


"HEAVY fog, ceiling zero," flashed by radio to the incoming air liner of tomorrow, will not cause its pilot even a momentary shiver of apprehension. He'll simply glance at an instrument, set the controls properly and follow an invisible beam from the clouds to the runway of the airport.

This picture of instrument, or "blind," landings is taking shape fast. The Civil Aeronautics Authority is just beginning to install, at ten airports, a system approved by a committee of the National Academy of Sciences, at the request of the President. The result of long study, this sys-



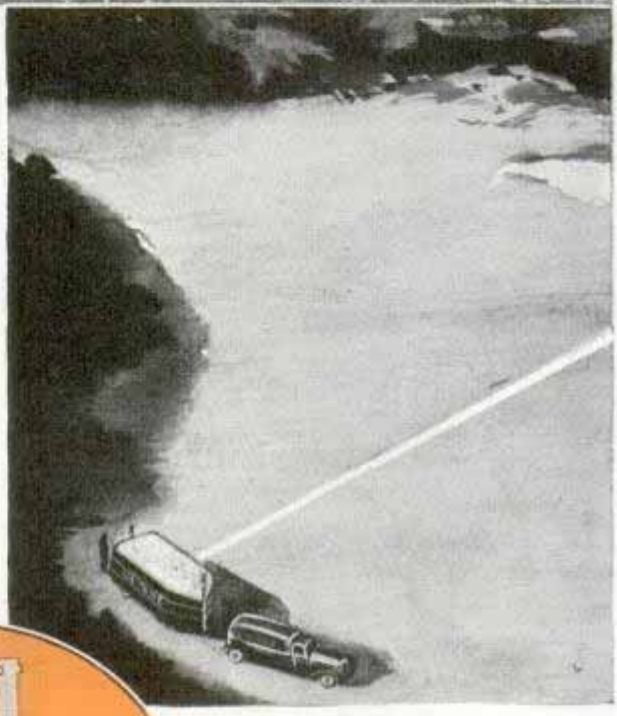
Flightray, a cathode-ray tube device to aid pilots, probably will facilitate instrument landings. A Sperry instrument, its indicator is shown closeup (bottom, left) and in plane (left of center panel). Bottom, right, typical installation

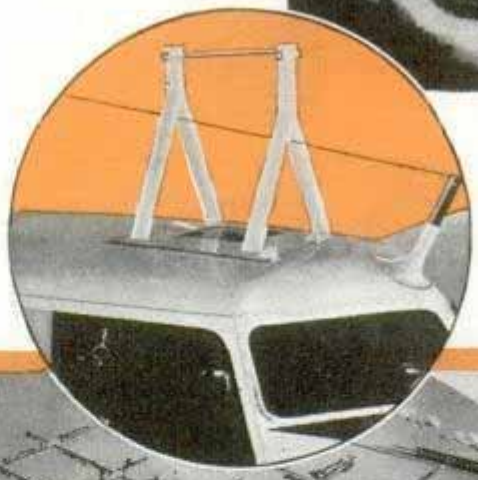


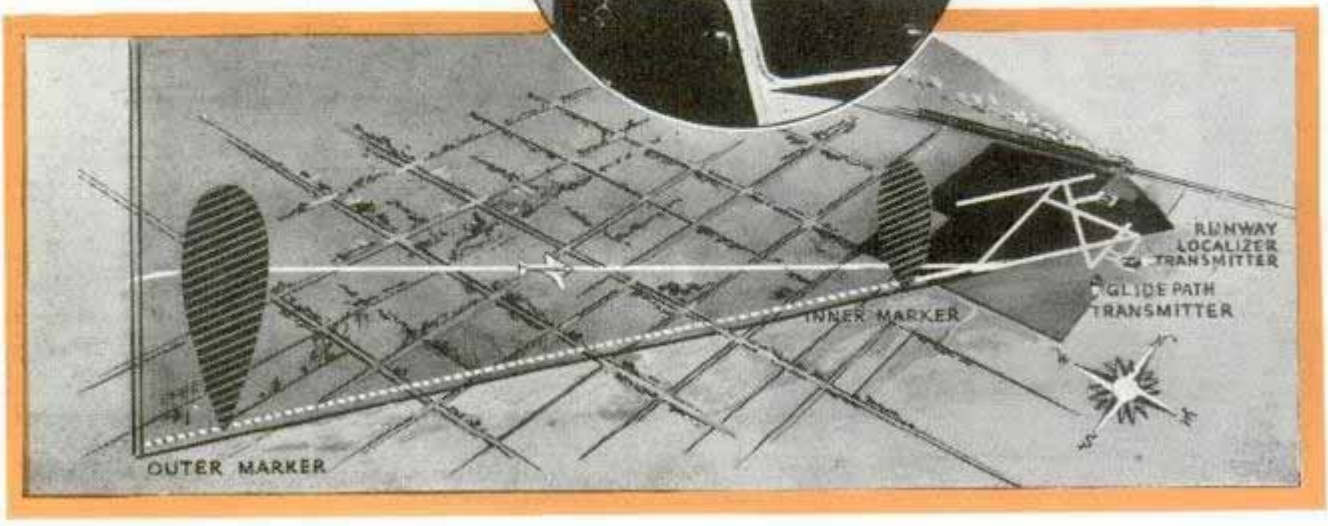
Indicator of the navy's "magnetic-beam" system is shown in plane (left). Apex of buried cables in navy's system is indicated by officer (right). Cables spread like a giant fan. Line at right leads to power-control station

tem employs short-wave radio-beam signals to guide the pilot to the earth through heavy rain, blinding snow, low ceiling and poor visibility. It is known as the Indianapolis system because the trial installation was made at the municipal airport at Indianapolis, Ind., where more than fifty test landings have been made successfully under all kinds of adverse weather conditions.

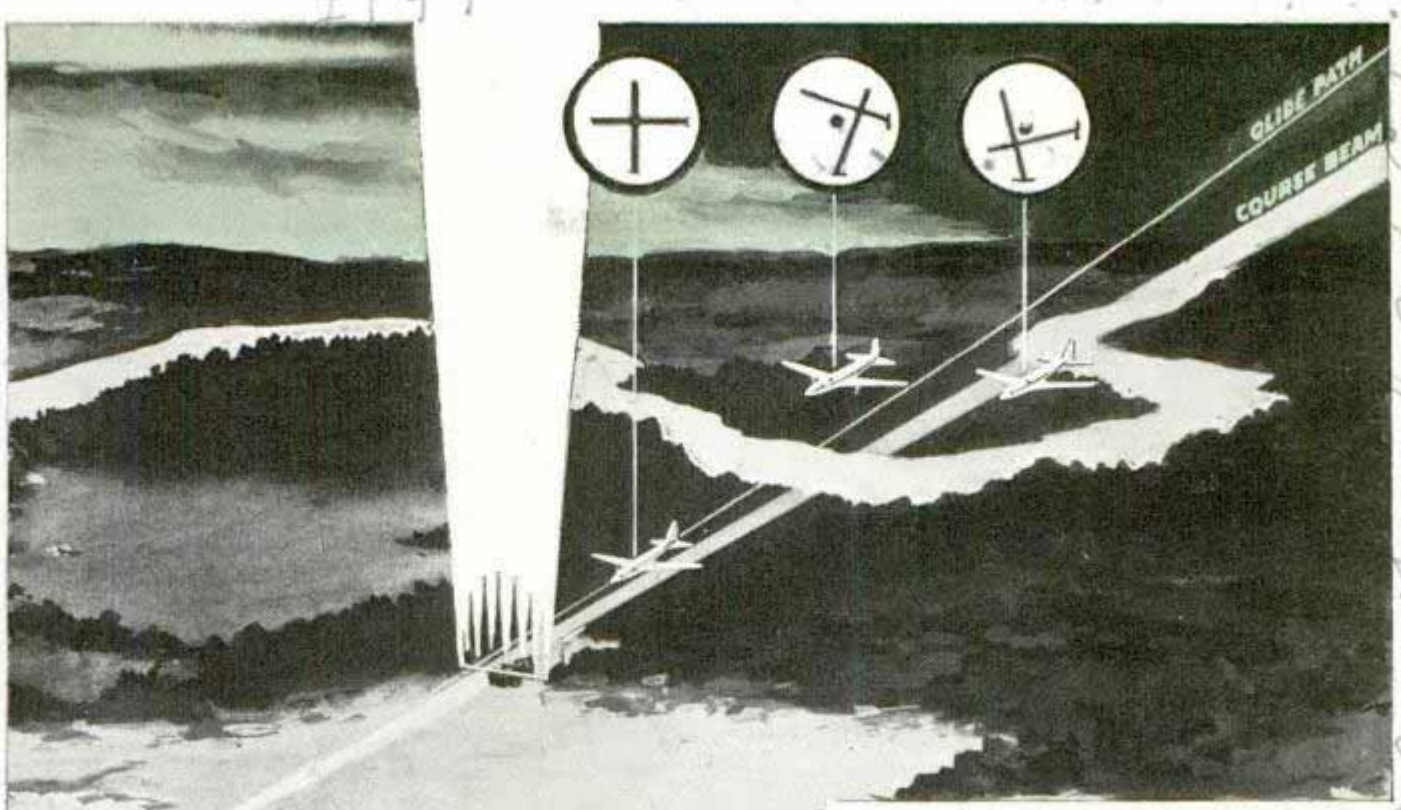
Three fundamental elements—a runway localizer beam which provides a range course for lateral guidance, a glide path or landing beam which provides the path of descent and two marker beacons for indicating the progress of approach to the landing field—make up the system. Radio waves used to create the glide path and marker points are 2.6 to four meters long. The glide path comes down in a straight line from 600 feet and goes into a slight curve near the ground to make the landing less abrupt.



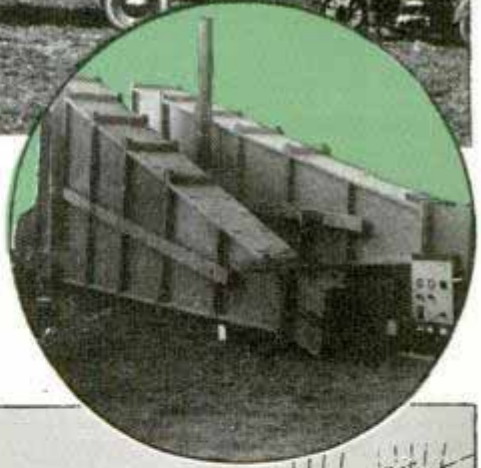




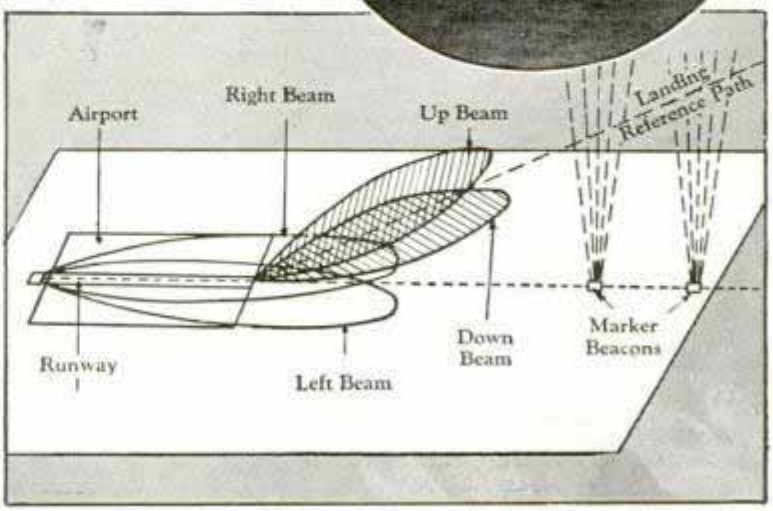
Left, localizer-glide path antenna on plane. Bottom, drawing of Indianapolis system approved for immediate installation at ten airports



Above, and on page opposite, drawing of Air-Track landing system. Note trailer and motorcycle transmitters. First circle (top) shows plane on course, others off course



Above, Air-Track system on the road. Right, horn antennas used in CAA-MIT landing system. Bottom, diagram of the same system showing how radio beams guide pilot



The runway localizer is a radio range in which the "on-course" beam is directed down the center line of the runway. The position of the airplane is then indicated to the pilot by the position of a vertical needle on a cross-pointer instrument, containing two pointers at right angles to each other, on the air liner's control panel. If the airplane is to the right of the runway, the vertical needle leans to the right; if to the left of the runway, the needle leans to the left. If the pilot keeps the needle in vertical position, by properly controlling his ship, he knows he is in the center of the runway.

The pilot is guided to the ground from a safe-approach altitude by

(Continued to page 151A)

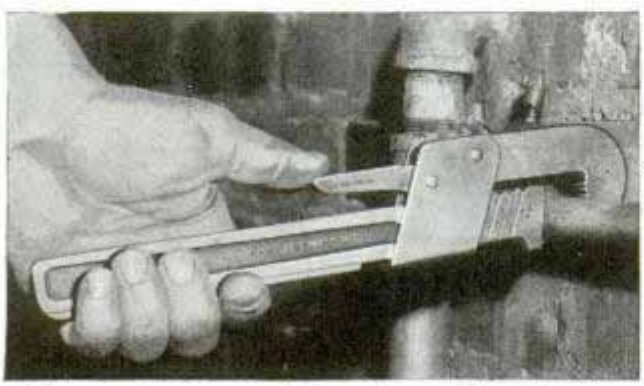
Photocell Checks Headlight by Scanning Beam Pattern

Condition of auto headlights is read on three dials of instrument that scans beam pattern with photocells

Automobile headlights are tested accurately with the aid of photoelectric cells that scan the beam pattern, which is reproduced on a principle similar to that used in modern telescopes. The condition of the lights is indicated on three dials which show vertical aim, lateral aim and candlepower, also locating the exact geometric center of the beam.

Trigger Wrench Opens Quickly to Take Firm Grip on Pipe

Faster operation is possible with a pipe wrench which has a thumb trigger instead of the customary screw adjustment. A calibrated scale of notches with quarter-inch variations guides the operator, the wrench jaws being adjusted by depressing the trigger and sliding the main carriage along the notches until it is extended to the desired opening. Then, depressing the trigger further spreads the jaws slightly to permit easy gripping of the pipe. The tool takes tight hold of the pipe when the trigger is released fully.



Trigger releases wrench jaws for quick adjustment

"Strain" Meter for Boat Rigging Sounds a Musical Note

Testing the strain on yacht rigging with a tension meter just introduced is like tuning a mandolin. The meter is clamped to a stay, the taut stay is plucked like a mandolin string and the musical note it gives off is then matched on a tuning wire by sliding a finger up and down the wire until the note is identical. Consulting a numerical scale under the tuning wire, and referring to a table, the load in pounds on the stay being tested can be read.

Comparing pitch of boat stay with that of tuning wire at left of meter enables computation of tension

Light of Firefly Found Too Costly for Practical Use by Man

Although the glow of the firefly can be reproduced in laboratories, practical use of this "cold light" would be far too costly and inefficient as compared with present artificial lighting, according to Dr. N. S.

Rustum Maluf of the Osborn zoological laboratory, Yale University. The firefly's light is the result of oxidation or burning of luciferin, a chemical substance. This reaction is dependent on a catalyst known as luciferase. The same phenomenon has been duplicated in a test tube with mixtures of luciferin, luciferase and oxygen, but because of the large amount of oxygen required it is a wasteful process. To quote one calculation, an area of firefly light six feet in diameter on the ceiling of a room nine feet high would give ample illumination for reading or drawing on a table three feet high. From the standpoint of illuminating efficiency this rates about one per cent, compared with 4.54 per cent for a carbon filament lamp, 17.17 for the acetylene flame and sixty per cent for the new sodium arc lights.

Life-Size Schoolgirl Pictures Warn Drivers to Slow Down

Schoolgirl, second from left, poses with life-size pictures of herself which are used as traffic signs near school to warn speeding motorists

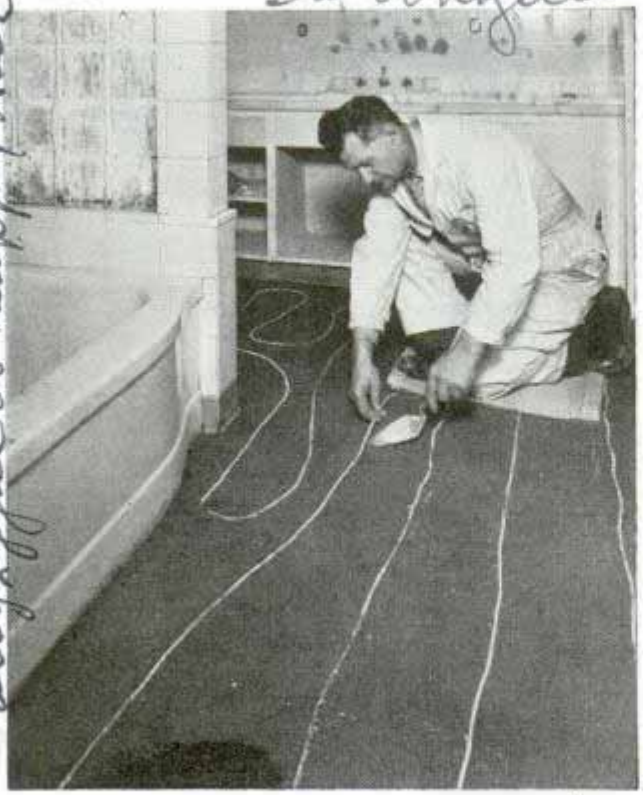
Slightly larger than life-size, pictures of a schoolgirl mounted on plastic boards serve as traffic police at crossings near schools in Tulsa, Okla. Drivers are warned to exercise caution when they see the figures, which are enlargements made from a color photograph of an eight-year-old girl.

Crawler for Potato Pickers Takes Backache Out of Job

Potato pickers can avoid the backbreaking effects of their task by building a three-wheel, self-propelled crawler designed at Michigan State College for picking potatoes turned up by the digger. The operator sits near the ground level with two bag-openings within easy reach. After a little practice he is able to work steadily at a pace equal to his top speed when picking into a crate, and with less injury to the potatoes. A three-quarter horsepower gasoline washing-machine engine drives the crawler by friction against the tire of the single rear wheel. It is steered by the feet and speed varies from one-tenth to about two miles per hour. It is said that the cost of building the crawler should not exceed fifty dollars if some secondhand material is used.

Potato picker sits near ground on powered crawler where he can reach potatoes turned up by digger and load them into bags at right and left sides

Tile Bathroom Floor Heated by Buried Electric Cable



Laying electric cables beneath tile floor of bathroom to warm floor at turn of a switch in bedroom

If hothouse flowers can have their feet warmed by electric cables in the soil, why not provide similar comfort for people? The idea has been adapted to warming the tile floor of a bathroom in a Los Angeles electric home. Sixty feet of half-inch cable such as is used for soil-warming purposes were laid under the tiling and connected with switches on the bathroom wall and in the adjoining master bedroom. Twenty minutes after either switch is turned on, the floor temperature reaches a maximum of eighty degrees. The heating unit is controlled by a thermostat.

Fuel Saver Vaporizes Raw Gas Which Passes Carburetor

Gasoline, when not sufficiently vaporized in a downdraft carburetor, flows along the walls of the manifold and is wasted because it does not burn completely. Designed to catch and vaporize this raw gas, an interceptor, now on the market, fits between the carburetor and the intake manifold. Its duty is to collect wet gas from the walls into a grooved ring that extends inward. Gasoline that accumulates in the ring is drawn toward an atomizer tube working on the Venturi principle, where the wet gas is vaporized and mixed with air passing through the tube. Then it is free to follow along with other vapor from the carburetor and help run the engine.

Aluminum Plated with Chrome or Nickel for Luster Finish

Two new metals, chrome aluminum and nickel aluminum, have been developed by an electrolytic method that produces a permanent bond. The result is a surface with the beauty and durability of nickel and chromium, backed by the lightness, strength and workability of aluminum. Four years of tests indicate the bonded metal can be fabricated into molding, reflectors, signs, kitchen utensils, automobile and aircraft accessories and similar products with assurance that the surface metal will not peel. The pre-finished metals are available in mirror or satin finish, striped, crimped or corrugated patterns.

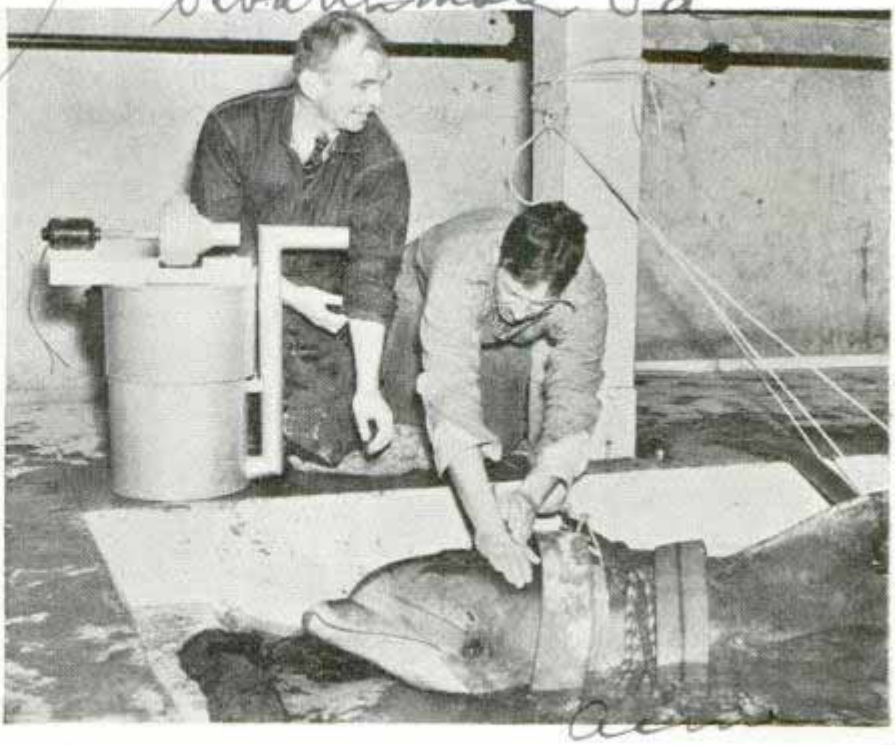
Paddle Board with Outriggers Resists Upsetting in Sea

To overcome a tendency of upsetting in rough water, paddle boards used along the west coast are being equipped with outriggers designed by the lifeguard service at Santa Monica, Calif. Floats extending outward from the board strike the water as it begins to roll and offer sufficient resistance to keep the craft from overturning.

Outriggers mounted on paddle board give stability to the narrow float and keep it from turning over

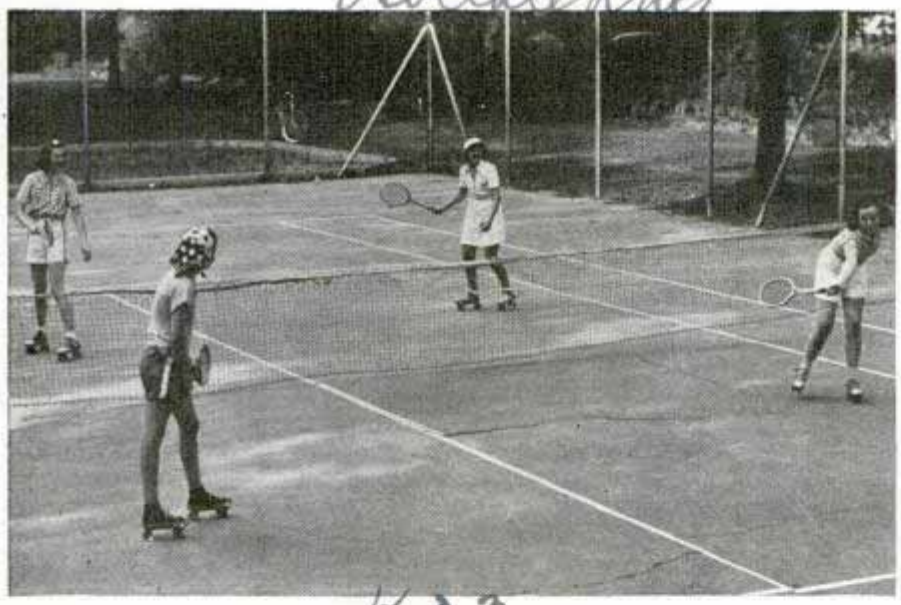
500-Pound Porpoise Dons 'Corset' for Science

Dressed in a corset fastened about its middle, a 500-pound porpoise swimming in a pool at Swarthmore college is having its heart action recorded. Scientists hope in this way to find a clue to the process by which nature supplies oxygen to the brain and tissues while the porpoise holds its breath in a dive under water. The recording apparatus is connected to electrodes on the corset.



Heart action of porpoise wearing corset is recorded by apparatus at left in picture to reveal source of oxygen

Tennis Players on Roller Skates Combine Two Sports

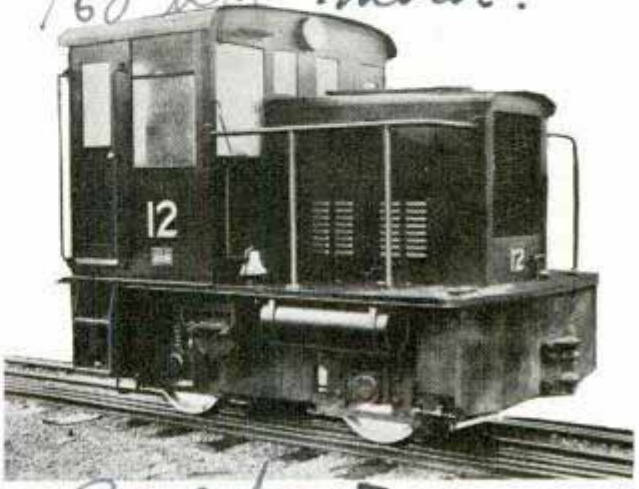


Playing tennis on roller skates has been introduced by sports enthusiasts who like both forms of exercise. Skating instead of running on the courts has proved less exhausting, yet it adds thrills to the game because difficulty in keeping balance frequently results in awkward spills.

Roller skating on the tennis court provides extra thrills and amusement. Players' skill is tested in avoiding spills while chasing the ball

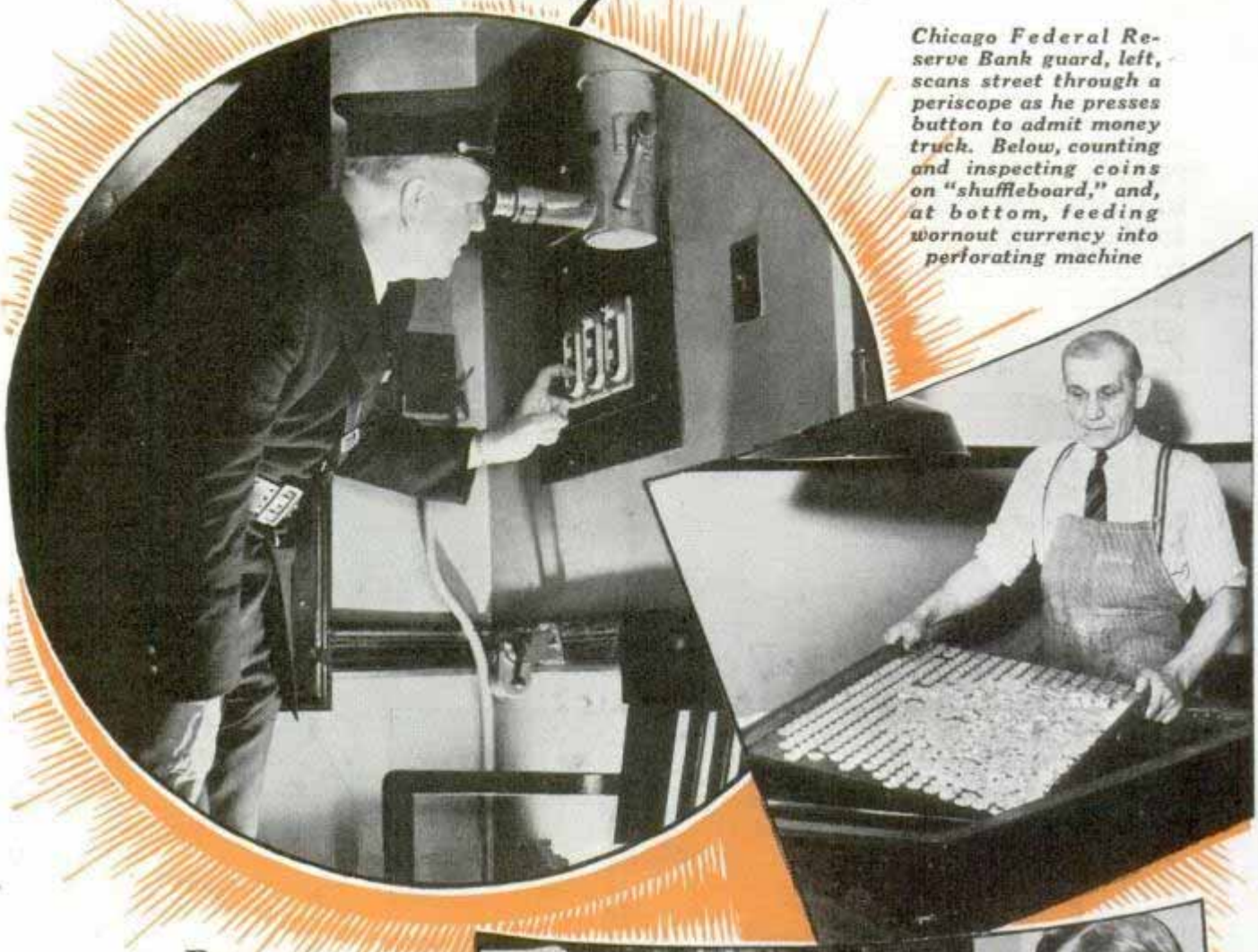
"Baby" Diesel-Electric Locomotive Runs on an Eighteen-Inch Track

Baby brother of the 5,400-horsepower Diesel-electric goliaths that pull America's swift streamline trains is the little 150-horsepower locomotive just built for a sugar company in the Philippines. This tiny Diesel-electric worker, weighing but twenty tons, comes from a General Electric plant at Erie, Pa. It will travel on eighteen-inch tracks, hauling sugar cane to the mill and refined sugar to the railroad.



On eighteen-inch tracks in the Philippines this 150-horsepower Diesel-electric locomotive will haul sugar cane to the mill

Handling MONEY



Chicago Federal Reserve Bank guard, left, scans street through a periscope as he presses button to admit money truck. Below, counting and inspecting coins on "shuffleboard," and, at bottom, feeding wornout currency into perforating machine

By
Roderick M. Grant

"THE king was in his counting house, counting out his money—"

The old song has a new tune, played by clinking silver on a wooden "shuffleboard," the whir of wheels in an automatic currency counter, copper jingling in a centrifuge and the clatter of typewriter keys punching out code messages that transfer millions over a network of telegraph wires linking Boston to San Francisco, Atlanta to Minneapolis.

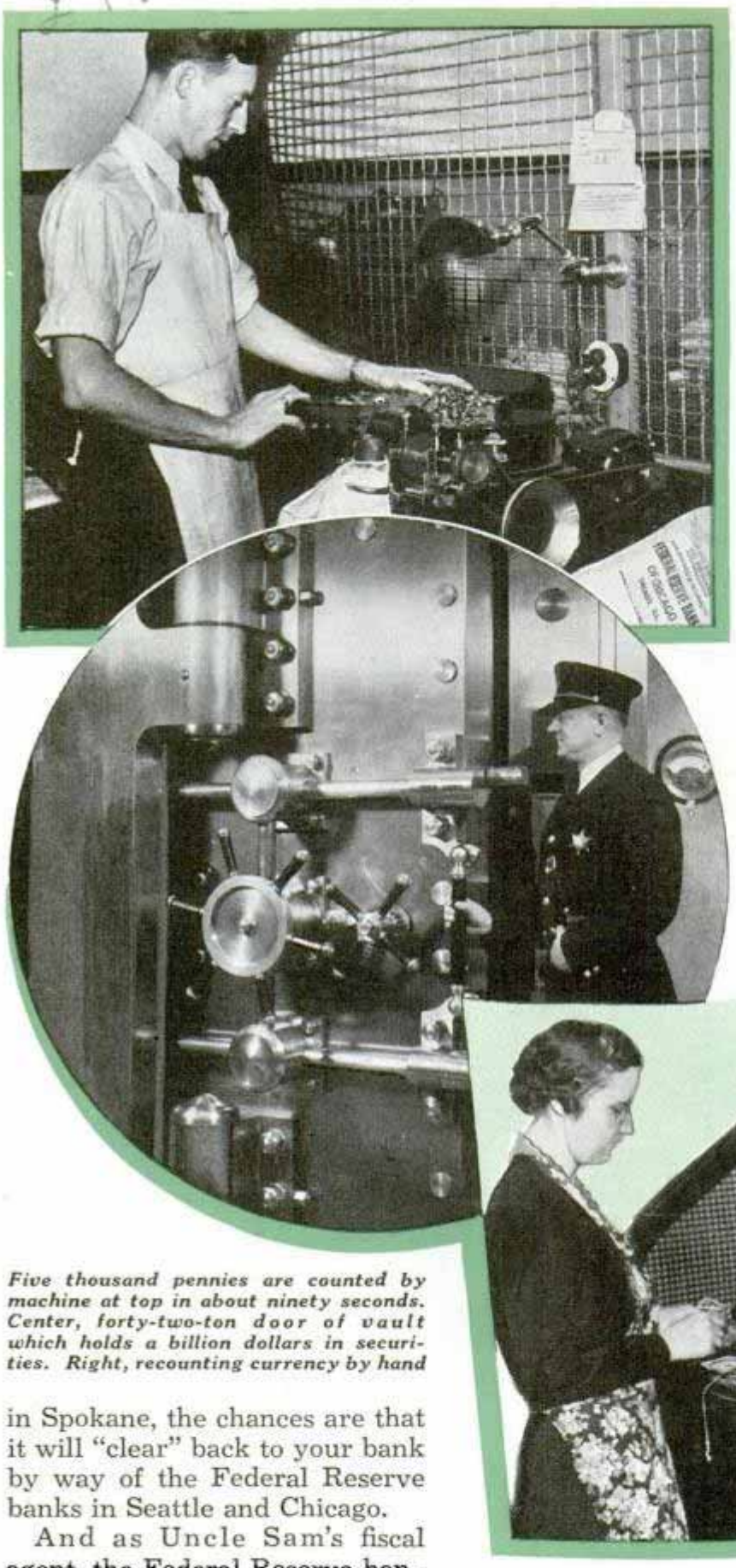
And the meaning of the song is changed, too. In place of the old king sifting a feudal fortune in gold coins through his fingers are hundreds of men and women weighing and counting, recounting, storing and shipping the billions of dollars in coin and currency and "paper" that pass through the Federal Reserve banks every year.

Walk in the front door of one of Uncle Sam's "counting houses," the Chicago Federal Reserve Bank, and the first person who notices you is a guard in a turret just inside the entrance, then another guard in a

by the TON

turret overlooking the upstairs banking floor. You can't see the guard, but you can see the loopholes for guns. And the first thing you notice is the scarcity of "customers" in this great banking cathedral; there are probably not a half dozen in sight. That's because the public doesn't do much business at the Federal Reserve. It's a "service station" for banks, controlled by the member banks themselves; and it's a bank for Uncle Sam. It's a central reservoir of coins, currency and credit; when your home town bank needs more cash to circulate in the Christmas or Easter or some other heavy shopping season, it draws a supply from the Federal Reserve, if it's a member of that system. It can borrow money from the big bank. It can turn notes and bonds over to the Federal Reserve for collection. And when you mail a check on the Kewanee bank to your aunt

Armed guards watch money unloaded, top. Center, coin bags are given preliminary check on scales. Bottom, a million dollars a day in unfit bills are sliced in half and sent to Washington



Five thousand pennies are counted by machine at top in about ninety seconds. Center, forty-two-ton door of vault which holds a billion dollars in securities. Right, recounting currency by hand

and the latter collects from the U. S. Treasury. One of the rare things it will do for you as an individual is to store for safekeeping free of charge in its vast vault your U. S. Savings bonds.

Staggering sums flow in and out of the Chicago bank every day. The cash department alone must receive and count about one million pieces of currency worth $4,500,000 daily, and pay out or ship about the same amount. Bales of money and bags of silver are handled in routine fashion like so many bags of seed; but the routine is rigid. Every employe must account for every cent. Nothing is left to chance. In a single year this one department has received and checked 655,000,000 bank notes and $1,675,000,000 in coins, and paid out about the same, without loss.

Let's watch a load coming in by armored car from an outlying bank. As it pulls up at the truck entrance a guard in the sentry box outside presses a button. A buzzer sounds in police headquarters inside the bank. An officer steps to the wall, swings a periscope handle and peers through the glass to see that the street is clear around

in Spokane, the chances are that it will "clear" back to your bank by way of the Federal Reserve banks in Seattle and Chicago.

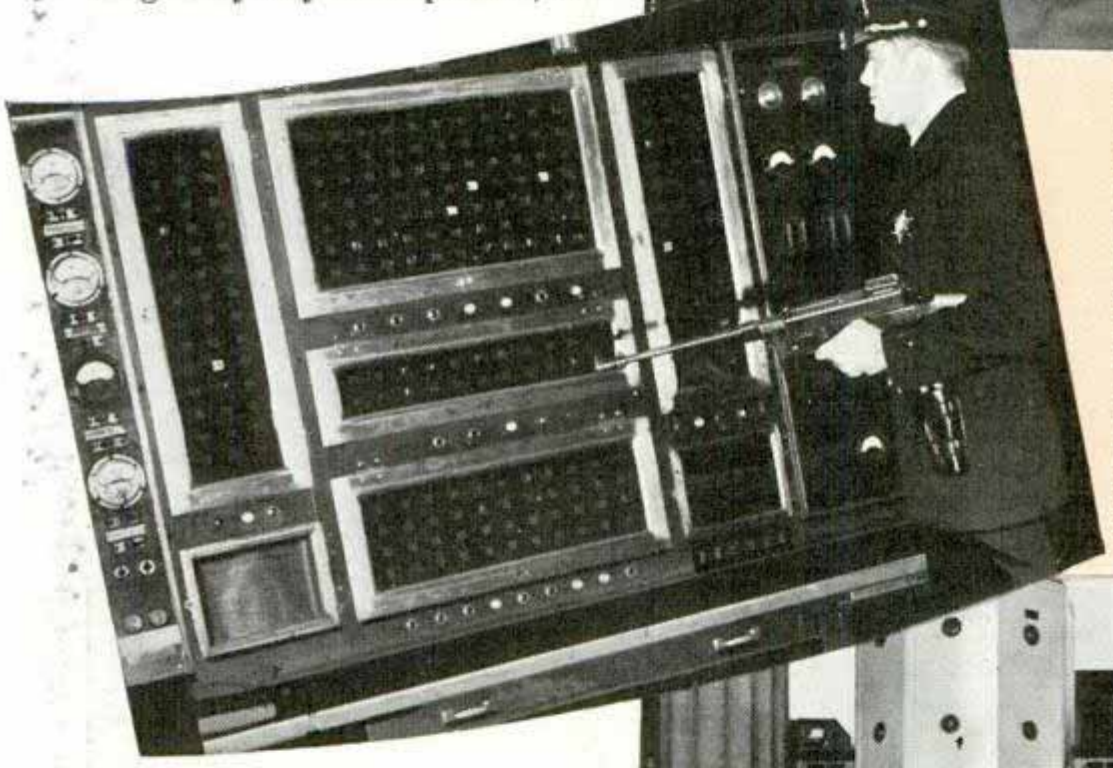
And as Uncle Sam's fiscal agent, the Federal Reserve handles all government pay checks and bond issues, acts as agent for the R.F.C., the Federal Farm Mortgage Corporation and a half dozen other government units. When you cash your pay check as postman, the bank collects from the Federal Reserve,

the waiting truck. He glances through a loophole into the garage, presses a button; the door rolls up, admits the truck, then closes.

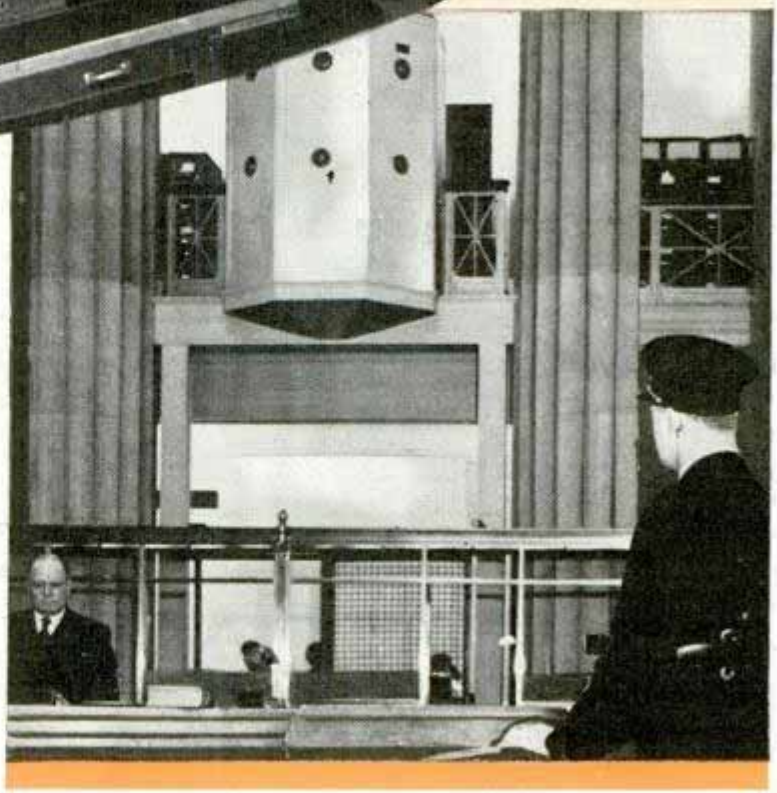
Sacks of money are unloaded and rolled into the cash receiving department. Now begins the sorting and counting. Coin bags are tossed on the scales for a preliminary check. A bag of nickels worth $250 weighs fifty-five pounds; $100 worth of pennies tip the scales at seventy pounds. Checking by weight is only a rough measure, for a $1,000 bag of new silver will weigh fifty-five and one-half pounds while silver that's been in circulation may weigh only fifty-three pounds; but the scales will show an error of ten dollars in $1,000. After weighing, the coin bags can be laid aside till there is opportunity for thorough counting.

Next stage in the coin department is the automatic coin counter, a spinning disk that makes short work of checking a fifty-dollar bag of pennies, counting 1,000 coins in fifteen to twenty seconds. Silver dollars, halves and quarters go on the "shuffleboard," a grooved wooden rectangle on which the coins regiment them-

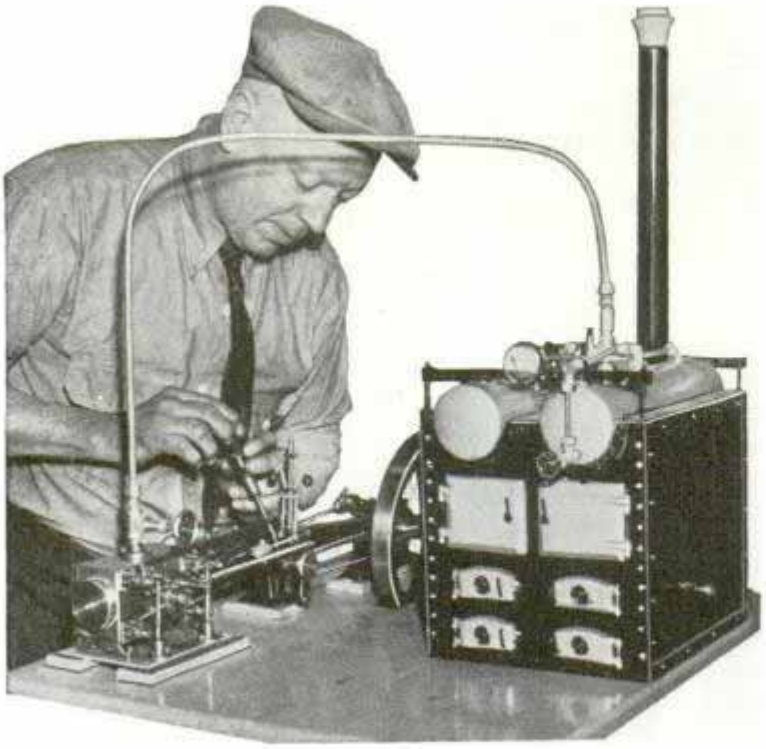
(Continued to page 146A)



Paper money is sorted into various compartments of automatic currency counter, above, according to type of bill and issuing bank; dial above each bin shows the total. The meter is so delicately adjusted it will refuse two bills fed in at once. At left is the alarm and guard signal panel in police headquarters of Chicago bank. Below, guard turret overlooking banking floor



Model of Engine and Boiler Made from Odds and Ends



This scale model of boiler and steam engine was constructed in four months of spare time from odds and ends in machine shop

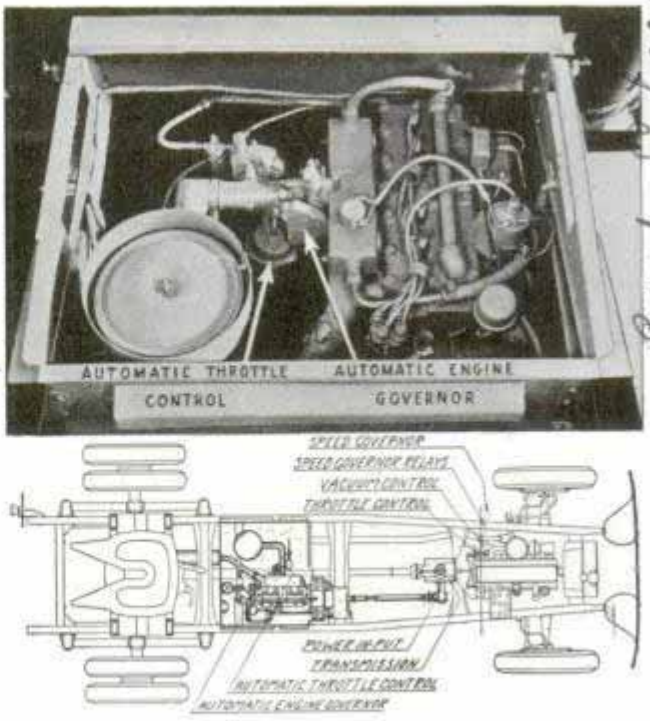
From odds and ends in his shop, a machinist of Utica, N. Y., in four months of spare time built a scale model of a Corliss steam engine and a steam boiler similar to those used in mills and factories for operating heavy machinery. The engine, capable of 500 revolutions a minute, has a bore of one and three-eighths inches, a two and three-fourths inch stroke, and a flywheel ten inches in diameter. Its likeness to a full-size engine is complete with the usual valve action, dashpots and governor attachments. The boiler, too, has a smokestack, water glass and valves, gauges and fire doors.

Polarized Headlights for Autos Await Solution of Problems

Several engineering problems call for solution before polarized auto headlights can be put into use, says P. J. Kent, chief electrical engineer of the Chrysler corporation. An essential step, of course, would be an agreement among manufacturers to equip all new automobiles with polarizing screens both on headlights and windshields. To do this a uniform method of "crossing" the screens must first be adopted. Old cars, too, could be given the benefit of the glare-eliminating effect by producing polarizing screens that could be mounted on their windshields. Even then it probably would be necessary also to have the new cars fitted with a beam-depressing switch so their strong lights could be lowered when meeting old-type cars. Furthermore it is still debatable whether headlights will have to be made brighter, Mr. Kent stated, in view of the fact that the polarizing screen cuts some sixty per cent from the beam thrown by the headlight, and a similar percentage of the light that reaches it is absorbed by the windshield screen.

Booster Engine for Truck Cuts in on Hard Pulls

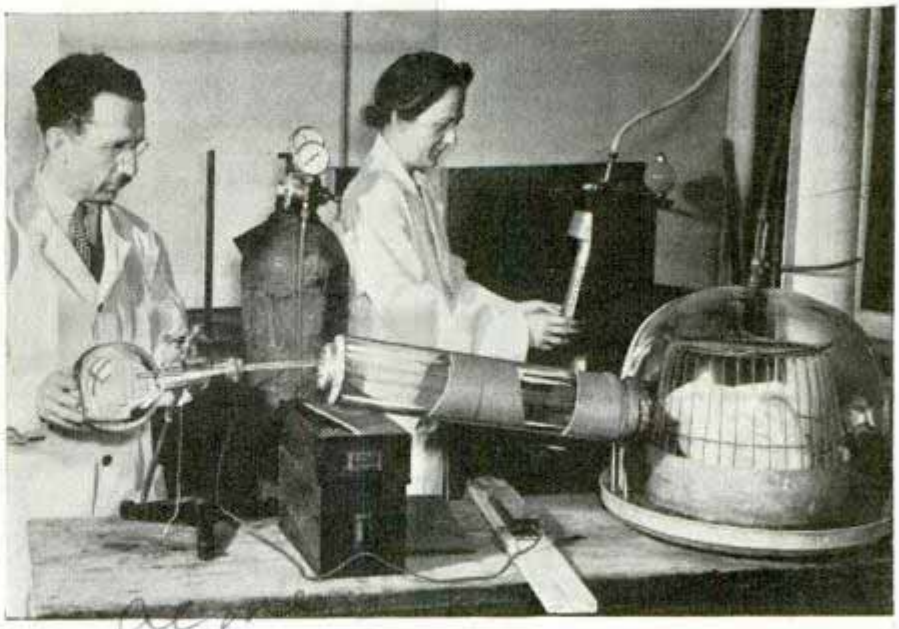
Auxiliary power for light trucks is supplied by a booster engine that cuts in only when the main engine needs assistance. A complete engine in itself, the booster operates automatically. For instance, when speed drops to thirty-one miles an hour on a steep hill, with the throttle wide open, a speed governor starts the booster engine and continues until a speed of forty miles an hour is attained, when it cuts out. This resets the vacuum switch ready for the next start. It helps acceleration by bringing the engines up to maxi-



Photograph above and sketch below show booster engine mounted on light truck and some of its controls

mum speed in second and third gears, and repeats the same cycle on the shift into fourth or direct gear. The forty-five horsepower, thus held in reserve, enables the truck to maintain a high average speed on long hauls, yet avoids waste of power and fuel on level roads. The booster engine, designed for installation only on a one and one-half ton Chevrolet truck or tractor, without making changes, is fitted by rubber mountings to the frame behind the cab, and delivers power through a short propeller shaft and universal joints to the transmission, using an overrunning clutch. The automatic controls are a speed governor, a vacuum governor, an accelerator governor, and a throttle operated automatically by the foot accelerator, all working together.

Robot Sneezes and Coughs to Aid in Study of Diseases

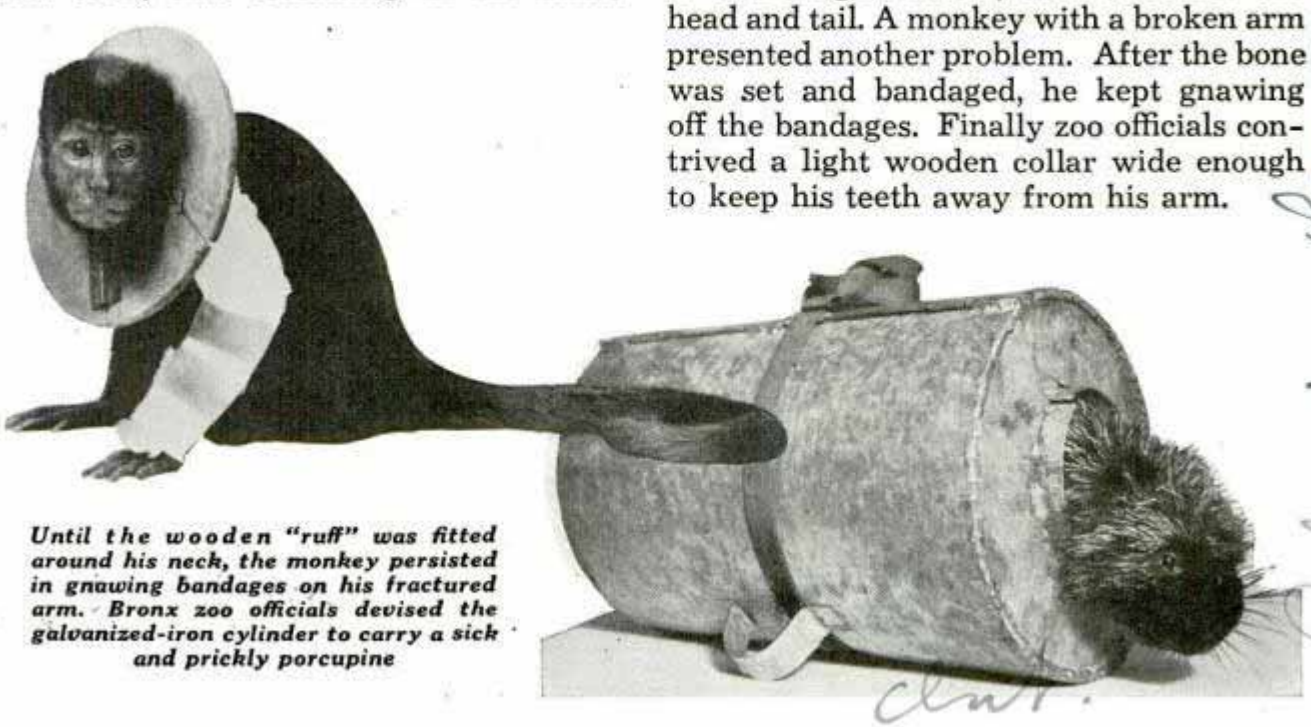


Caged rabbit sniffs at muzzle of sneezing and coughing machine that scientists have developed to help in their study of air-borne disease germs

Contagious effects of air-borne germs are being studied at the University of Pennsylvania medical school with the aid of an apparatus that sneezes and coughs infectious germs. By shooting the germs with a compressed-air gun into a glass bell, in which a rabbit waits to catch cold or tuberculosis, scientists simulate natural conditions where humans contract illness through inhaling infections spread by others.

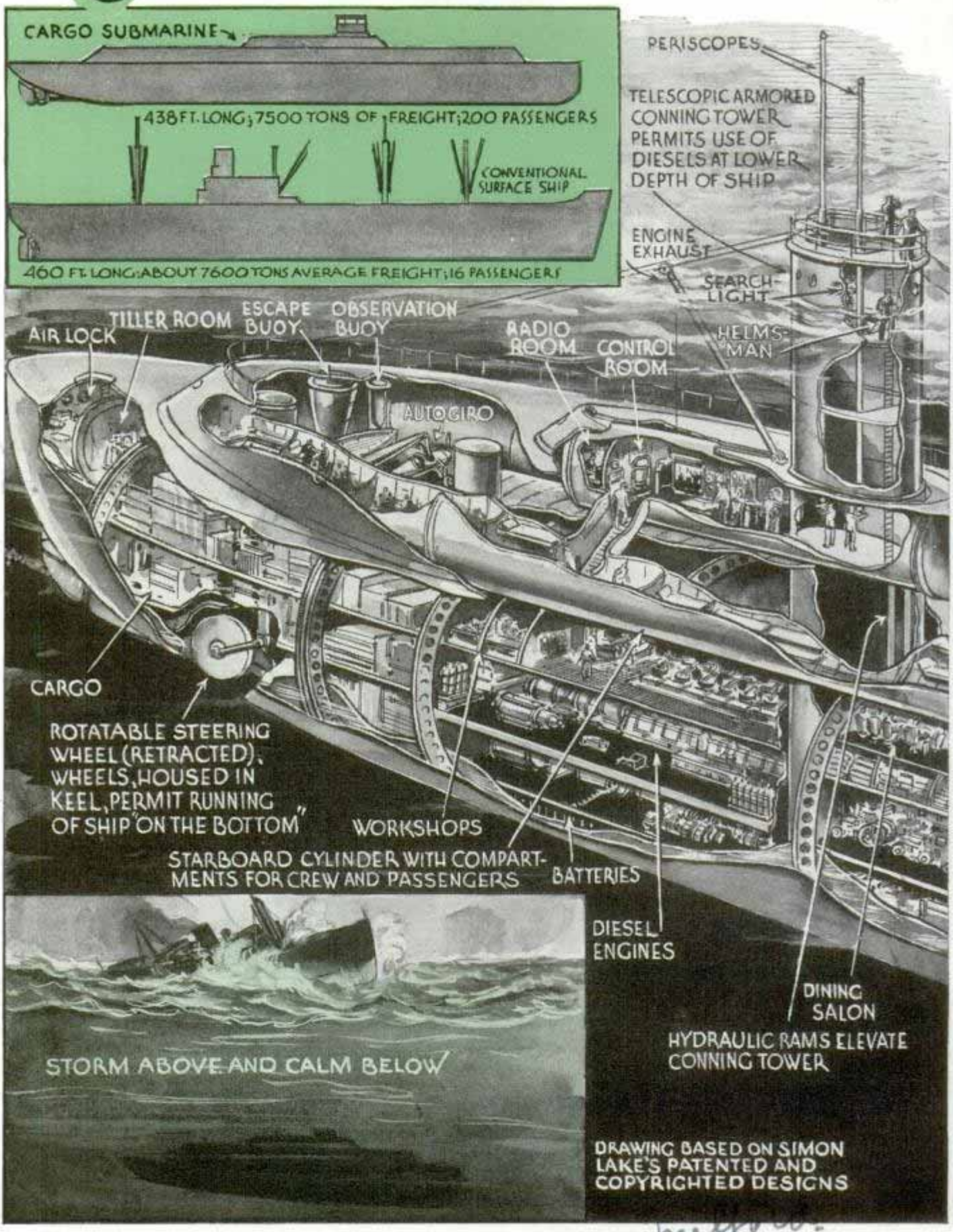
Porcupine Rides in Iron Can and Monkey Wears a 'Ruff'

Human patients sometimes are difficult to handle—but how about the patients at the zoo? The doctor at the Bronx Zoo hospital really has something on his hands when the porcupine gets sick. A special carrier had to be devised for the prickly animal; a galvanized-iron cylinder made of two hinged halves, with holes for the head and tail. A monkey with a broken arm presented another problem. After the bone was set and bandaged, he kept gnawing off the bandages. Finally zoo officials contrived a light wooden collar wide enough to keep his teeth away from his arm.



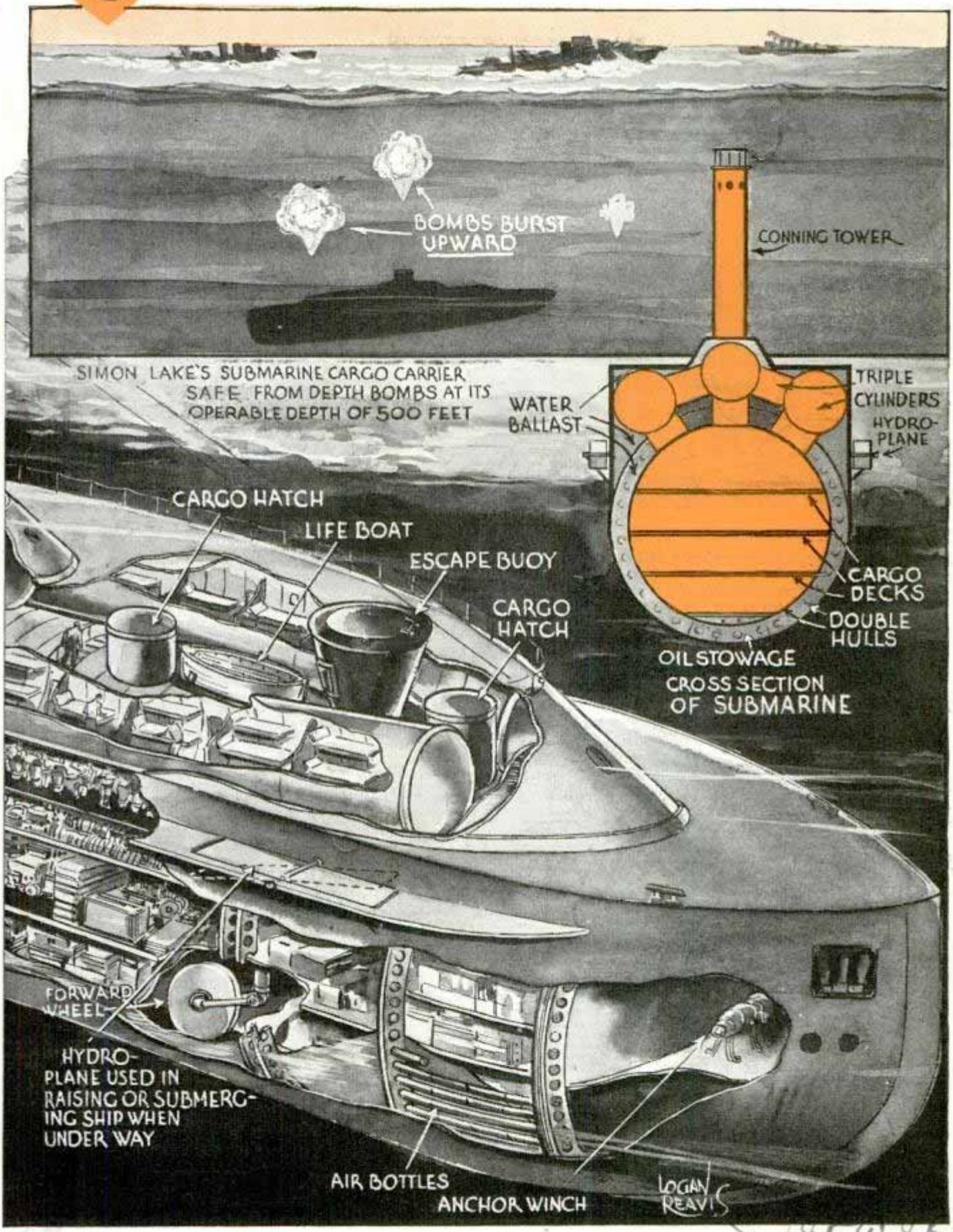
Until the wooden "ruff" was fitted around his neck, the monkey persisted in gnawing bandages on his fractured arm. Bronx zoo officials devised the galvanized-iron cylinder to carry a sick and prickly porcupine

UNDER WATER


CARGO SUBMARINE
438 FT. LONG; 7500 TONS OF FREIGHT; 200 PASSENGERS
CONVENTIONAL SURFACE SHIP
460 FT. LONG; ABOUT 7600 TONS AVERAGE FREIGHT; 16 PASSENGERS
PERISCOPES
TELESCOPIC ARMORED CONNING TOWER PERMITS USE OF DIESELS AT LOWER DEPTH OF SHIP
ENGINE EXHAUST
SEARCH-LIGHT
HELMS-MAN
AIR LOCK
TILLER ROOM
ESCAPE BUOY
OBSERVATION BUOY
RADIO ROOM
CONTROL ROOM
AUTOGIRO
CARGO
ROTATABLE STEERING WHEEL (RETRACTED), WHEELS, HOUSED IN KEEL, PERMIT RUNNING OF SHIP "ON THE BOTTOM"
WORKSHOPS
STARBOARD CYLINDER WITH COMPARTMENTS FOR CREW AND PASSENGERS
BATTERIES
DIESEL ENGINES
DINING SALON
HYDRAULIC RAMS ELEVATE CONNING TOWER
STORM ABOVE AND CALM BELOW
DRAWING BASED ON SIMON LAKE'S PATENTED AND COPYRIGHTED DESIGNS

Cargo-carrying submarines, of the type shown in these drawings based on Simon Lake's copyrighted designs, may solve war-time shipping problems and may permit ocean freight to reach ports closed to surface vessels by ice. Among its features is an observation buoy in which a member of the crew could rise to the surface and look around

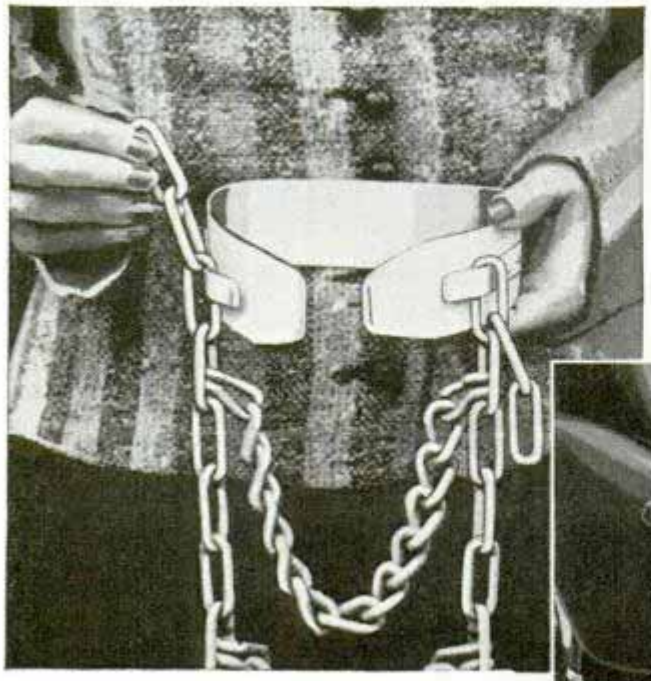
CARGO CARRIER

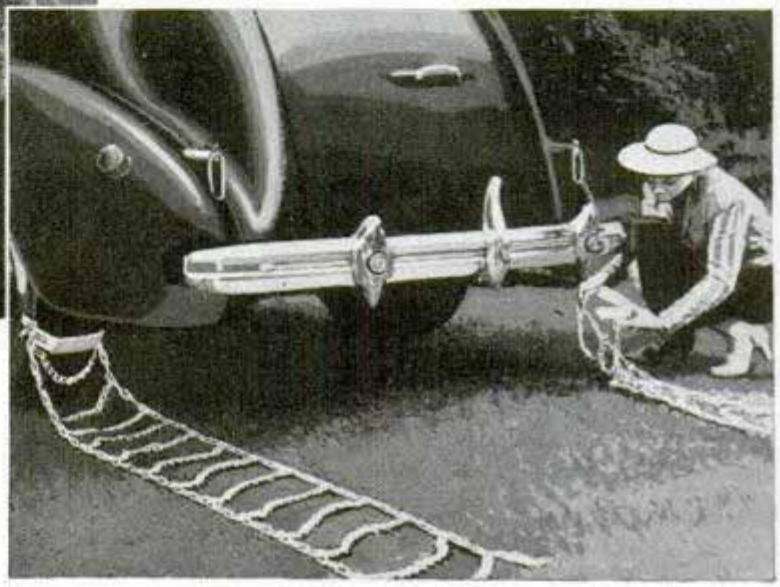


Simon Lake's designs call for all-welded construction, special life-saving features, strength to permit submerging to 500-foot depths, a surface speed of twelve knots and a submerged speed of ten, space for 7,500 tons of freight and 200 passengers in an underwater craft 438 feet long and retractable wheels which permit running on ocean floor

Spring Clamp Helps Put Tire Chains on Car

Wrapping non-skid chains around automobile tires becomes an easy job when they are applied with the aid of a spring clamp that grips the tire and holds the chain. Links near the free end of the chain are hooked over two clips before the clamp is slipped over the tire at the rear. Then straighten out the chains behind the car so the wheels will pick them up as you drive forward. When the clamp has made a complete turn the chains will be snugly fitted around the tire and ready to be locked in place. The maker claims anyone can put on chains with the aid of the clamp in less than five minutes.





Above, holding spring clamp with tire chain hooked on clips. When chain is straightened out as at right, wheel will pick it up when car moves forward, wrapping it around tire so it may be locked easily

Water Wings Keep Plane Afloat If Forced Down at Sea

Water wings that inflate automatically when an airplane is forced down at sea have been developed by the U. S. Navy for the planes attached to aircraft carriers. These planes must have wheeled gear for landing on decks, and the addition of pontoons would cut down their speed and maneuverability, hence the development of water wings. Made of tough, rubberized material, they fit into compartments on wings and fuselage and are quickly inflated from flasks of carbon-dioxide gas the moment the plane strikes the water, even if the pilot is unconscious. Automatic moisture detectors which are not affected by rain or fog start the flow of gas. One plane was kept afloat nearly twenty-four hours.

As soon as this land plane hit the water, rubberized water wings automatically filled with carbon dioxide which could keep it afloat nearly a day

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More than 970,000,000 incandescent lamps were sold in the United States during 1939, a new high record.

The WORLD'S BIGGEST CHESS GAME

J1282

497

Heavy cruisers executing a turn (top); U.S.S. "Texas" firing (center, left); members of Marine Corps guard of Flagship U.S.S. "Pennsylvania" holding loading drill on machine similar to five-inch gun (right). U.S.S. "Lexington" passing through the Panama Canal (Bottom).

Units of heavy cruiser scouting force deploying from line formation (above). This photo was taken from quarterdeck of U.S.S. "Chicago." Left, activity on bridge of the "Wyoming."

By Commander Leland P. Lovette
United States Navy

FROM the "wooden walls" of the Revolution and the War of 1812 to the ironclads of the Civil War, and the destroyers of the World War, the United States Navy has been an important factor in every war in which this country has been engaged. Today the navy stands as the outer bulwark of American defense.

Naturally the American people are much concerned with their fleet. What have we built and what are we building? What policy are we pursuing as regards the various types? What are their functions in real action?

In general it may be said that this country is building in an orderly manner a homogeneous, well-balanced fleet. Or, to put it in football language, it means a smooth offensive team, for which the successful functioning of each position or player is required for victory. We do not want too many guards (battleships), and too few backs (aircraft carriers) for unleashing the air attack. We want a balance in the tackles (cruisers) and the ends (anti-aircraft defense).

Each unit in each type must be trained to fulfill its mission as a type before go-

ing into the great team. For example, destroyers must be able to fire torpedoes accurately alone, or in a division, before going into the squadrons that may be ordered at a psychological moment in a fleet action to drive home a well-timed, concerted mass attack against an enemy battle line. The larger the units, the more complicated the maneuver. In major maneuvers and fleet problems the battleships, aircraft carriers, light and heavy cruisers, destroyers and submarines work together in order to give the vital training in strategy and tactics necessary to win battles. Strategy prepares and leads up to battle while tactics fight the battle when the action begins. Each subject may well occupy the full time of a naval officer for life.

To direct, co-ordinate and to fight a great fleet is a formidable task. It may be compared to controlling and moving the pieces in a huge chess game where at times it is impossible to see or find out what lies on certain squares of the board. Admiral Leahy once told Congress that, "A navy capable of providing an adequate defense for this country must be sufficiently strong to defeat the enemy fleet wherever it can be brought to action." To bring an enemy fleet to action where the enemy desires is one thing; to force action on one's own terms is another.

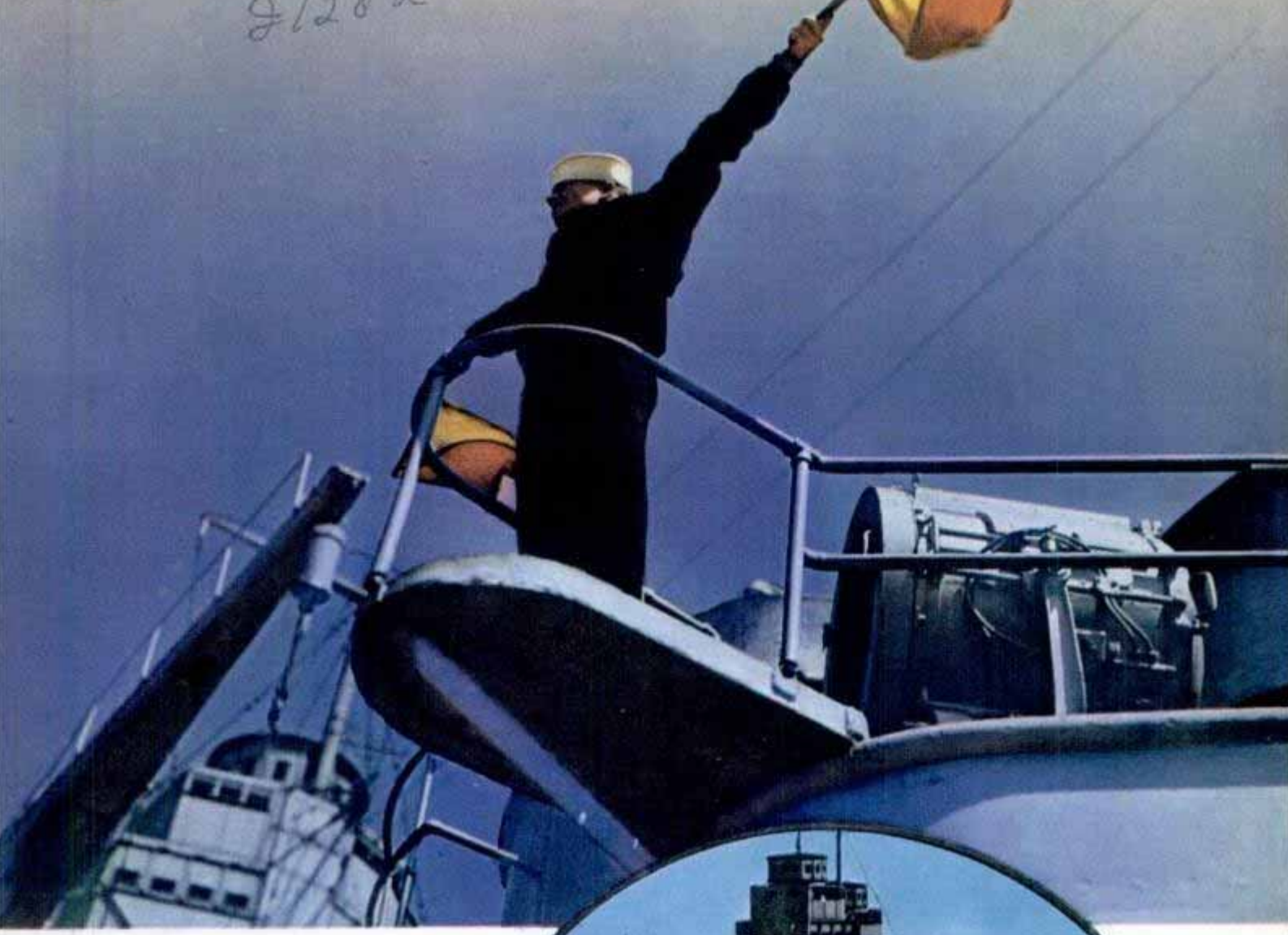
Target ship being blown up by mine (top). Bottom, plywood target, shaped like cruiser, being towed to sea for demonstration of accuracy of guns ashore. This target was used in gunnery practice at Fortress Monroe, Va.

Four pursuit bombers roar over zigzagging units of heavy cruiser scouting force (above). Charting fleet course and ship disposition (below) during maneuvers. Admiral Claude C. Bloch is at left, Captain Robert A. Theobald, chief of staff to Admiral Bloch, at right in the "Pennsylvania's" chart room.

The classical fleet action is effected by such steps as: knowledge the enemy fleet is at sea, searching and scouting with airplanes and surface vessels over vast ocean areas to locate the main body or the battle fleet; and making submarine and night light-force attacks for purpose of harassment and attrition before the two fleets are proximate. Here strategy is involved to decide where the enemy may be brought to action in localities or under conditions the most favorable to our fleet and with all the combatant forces concentrated. Three senior officers who will make the major general decisions are Commander-in-

Chief, U. S. Fleet; Commander Battle Force and Commander Battleship Divisions.

Then, when action approaches, the Commander-in-Chief must decide upon his plan of battle, issue the necessary orders to all units, make a deployment of his force for battle, give the order to commence firing at favorable ranges, make every effort to insure that he will gain command of the air quickly, receive all reports of enemy units sighted, be prepared for certain surprises, keep an accurate picture of his own and enemy units as they shift position and change course at high speed over hundreds of square miles of ocean.



A message goes out to the fleet as the signalman uses the semaphore system (above). This picture is a natural color photograph. Bottom, The powerful U.S.S. "Arizona" dipping her nose into the sea as she plows along during maneuvers.

Top photo courtesy U. S. Navy Recruiting Bureau

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Scouting bomber planes of the navy (above) present a picture of precision flying as they roar in formation through the clouds. In case of warfare, this type of craft might act as the "eyes" of the navy or might inflict considerable damage on enemy ships.

He must always maintain maximum concentration of ships and gunfire compatible with flexibility and maneuverability of the various units. Every advantage must be pursued. The traditional American offensive must ever be pushed.

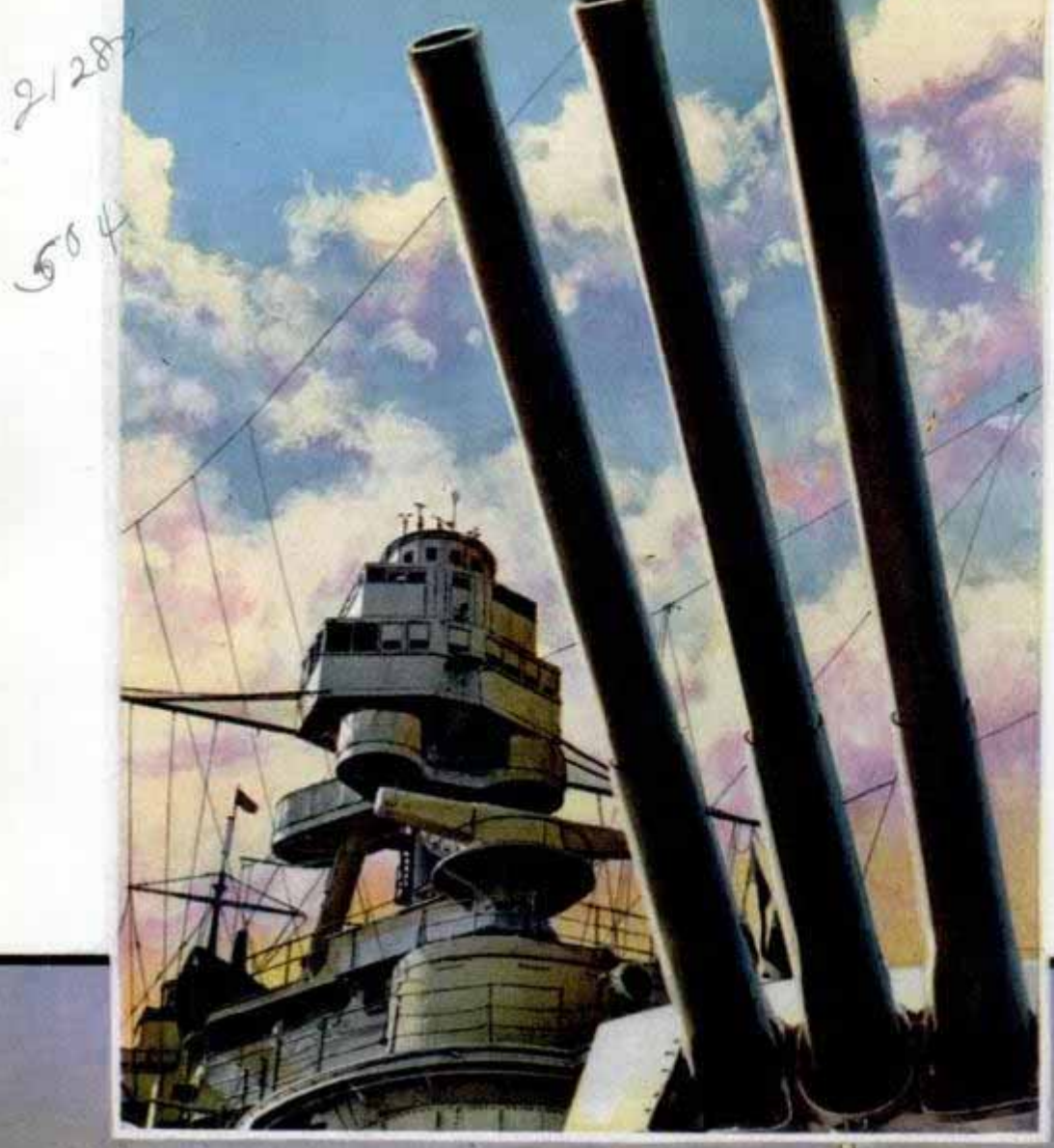
Each type, indeed each ship, is designed for a specific function, but it is quite impossible to embody in any one type all the defensive and offensive essentials—weight must be sacrificed for speed, and bulk for maneuverability. Somewhere in the design of every ship there is a compromise.

The following table shows the present naval strength of the United States and indicates the number of ships building:

Type	Built	Building	Total
Battleships	15	8	23
Aircraft Carriers	5	2	7
Heavy and Light Cruisers	37	4	41
Destroyers (including 8 mine layers)	230	34	264
Submarines	96	18	114
Totals	383	66	449

The great majority of experts of all naval powers agree that the battleship is the backbone of the fleet. These large, heavily armored vessels with the largest guns pack the great punch and embody the maximum offensive and defense

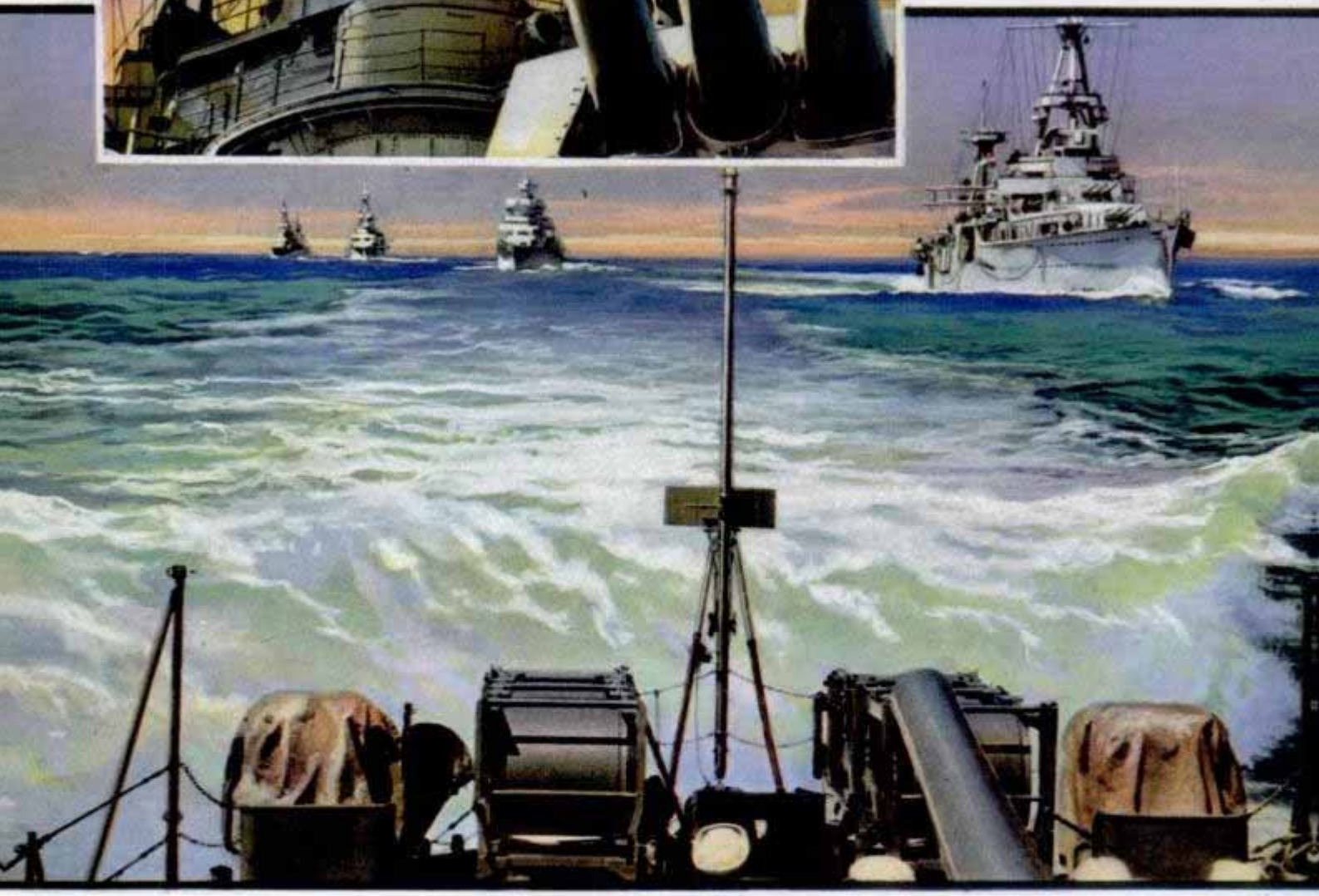
U.S.S. "Yorktown" goes to sea with its load of "birds"—the navy's scouting and fighting planes (above). Navigator plotting his position aboard one of Uncle Sam's mighty fighting ships (center). During maneuvers the fleet engages in sham battles at sea that give every officer and man invaluable training in the handling of their ships. Bottom, the fourteen-inch guns of the U.S.S. "Pennsylvania" being swung into position for action against the "enemy." Larger-caliber guns — sixteen-inch weapons — are carried by some American fighting ships.



strength of sea power. It is the power of survival combined with enormous striking power that gives the battleship its superior value in a fleet. A battleship is capable of engaging any type met on the high seas, but, of course, should have protection by smaller craft in any zone where submarines may be expected. Modern battleships may have speeds of thirty knots and carry guns up to sixteen-inch caliber. The American Navy has placed armament and armor ahead of speed in order of desirability.

The United States

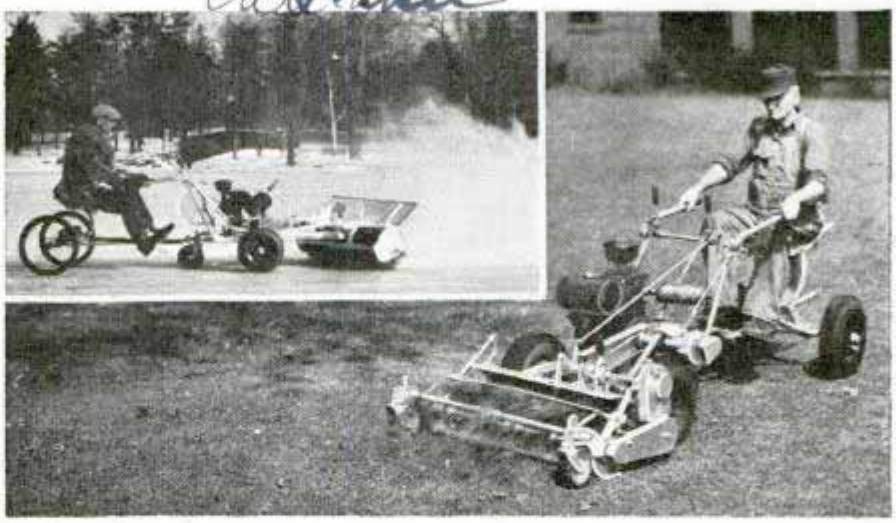
(Cont. on page 128A)



Powerful guns trained on a theoretical enemy (top). In background rise the foretops, navigating bridge and signal bridge of the dreadnought. Bottom, heavy cruisers in column during maneuvers, as viewed from deck of destroyer, present an inspiring picture.

Power Unit Pushes Lawnmower or Snowplow

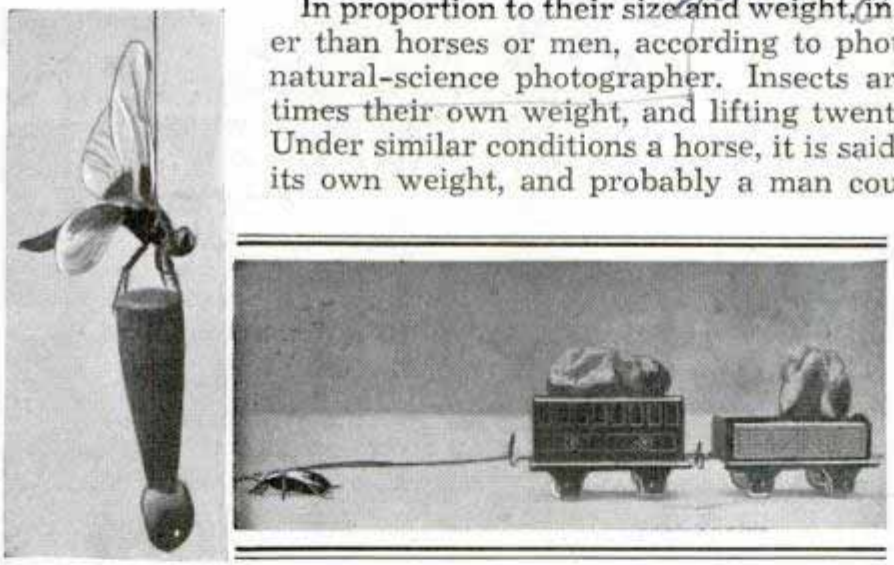
There is no seasonal rest for a versatile power unit that performs a variety of tasks at all times of the year around the lawn or park. In summer it is used for pushing the lawnmower, roller or spiker, and it will also operate a spraying outfit. A rotating broom mounted in place of the lawnmower will sweep snow in winter as well as clean walks or sweep the lawn in summer. Snowplows, either the V-shaped or single-blade type, may be attached if desired. The standard-size pusher has a two-horsepower engine, and the heavy-duty model uses one of three horsepower. For operators who do not care to walk, a riding trailer with a spring seat is available.



Pusher driving lawnmower in summer also carries operator on a riding trailer; inset, upper left, shows unit pushing snow sweeper during winter

Insect Stronger Than a Horse in Proportion to Its Size

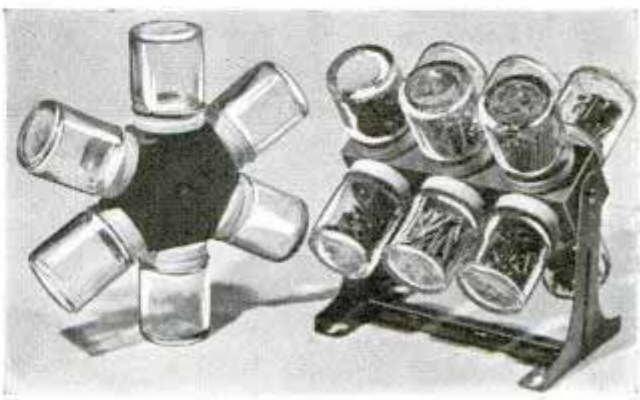
In proportion to their size and weight, insects are many times stronger than horses or men, according to photographs taken by a British natural-science photographer. Insects are shown pulling 150 to 530 times their own weight, and lifting twenty to 104 times their weight. Under similar conditions a horse, it is said, could pull a load five times its own weight, and probably a man could do the same thing for a short distance. The smaller the insect, the greater is its proportionate strength. In one instance a dragon fly, weighing four grains, lifted eighty grains, whereas an earwig can lift splinters of wood 104 times its weight. A ground beetle moved a weight 162 times as heavy as itself.



Left, dragon fly suspended by thread clings to object ten times its own weight; right, load tugged by beetle weighs 162 times as much as insect

Rotary Rack Holds Glass Jars for the Workshop or Kitchen Supplies

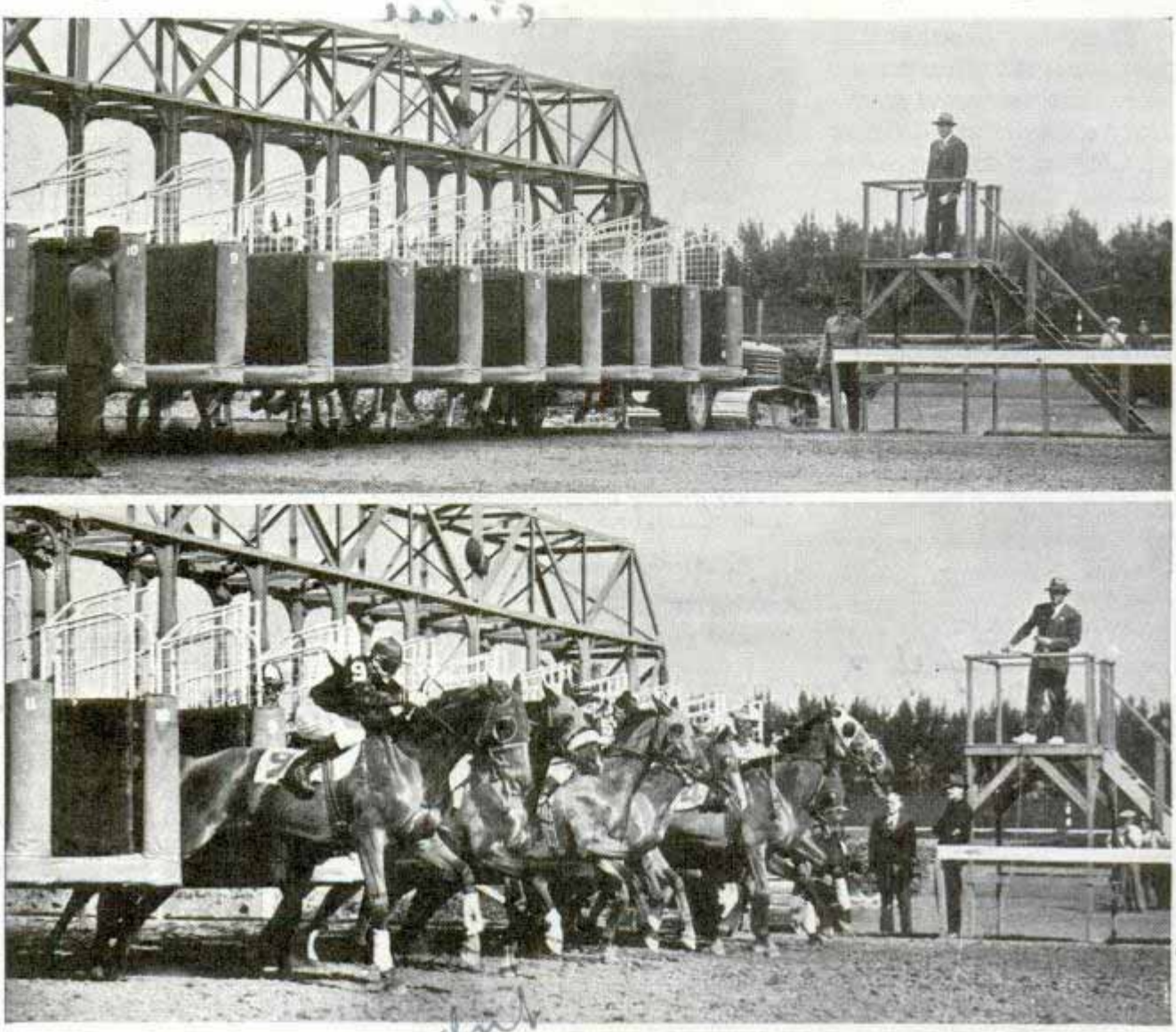
Small supplies for the workshop, garage or kitchen can be stored handily in a rotary rack of glass containers. One model fits conveniently on the wall, another is designed for the workbench. Screws, nails, buttons, pins, soaps, powders and food supplies are kept visible and free from dust.



Rack at left fastens on wall; right, table mounting

There were 43,300 locomotives on U. S. railways at the close of 1939 and 28,700 of them, or about sixty-six per cent, were twenty or more years old.

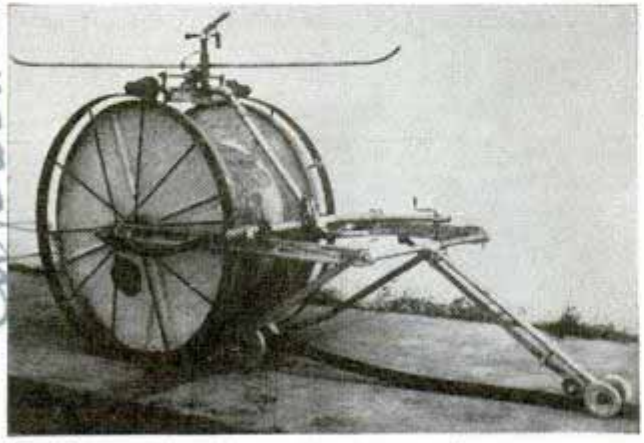
Magnetic Gate Gets Racers Away Together



Top, race horses locked in magnetic gate cannot jostle their neighbor if they become restless. Below, ***they're off to a fair start as soon as starter presses switch that opens all gates at one time***

Fair starts are assured all race horses when a magnetic control gate developed by Westinghouse Electric and Manufacturing company in cooperation with track authorities is used. Locked inside individual stalls, horses cannot kick up a fuss at the barrier. Gates in front of the stalls, held closed by magnets, open simultaneously at the press of a button which breaks an electric circuit and demagnetizes the magnets.

Traveling Sprinkler Reels in Hose as It Waters the Lawn



Sprinkler pulls self over lawn by winding hose on reel

Rewinding the hose as it travels along, a combination water sprinkler and hose reel can cover a path 300 feet long or can be adjusted to stop at any intermediate point. Simple friction drives and low-gear ratios move the sprinkler evenly and slowly under normal water pressure. It is capable of sprinkling a swath 100 feet wide.

¶First recorded use of lubrication was on the wheels of racing and war chariots about 1500 B.C., when beef or mutton tallow was the lubricant.

Vacuum Gauge Tests Tightness of Car Body

Auto-body ventilation, heretofore left to human judgment, is now tested by a gauge that will tell engineers if the car is too leaky or too tight, so corrections can be made. The car window is lowered partly in making the test developed by Chrysler Corporation, and a matched section of glass fitted with a funnel connected to a motor-driven fan is sealed over the window opening. Then air is drawn from the car and the gauge indicates the vacuum resulting inside the body. If the reading shows a minimum of one inch of water vacuum, the car is acceptable. However, should the vacuum reading be lower than one inch, an inspector mends the leaks to bring it up to standard. Cars found to be too thoroughly sealed also are corrected. To find leaks a man inside the car moves a burning candle near likely parts of the car while the suction fan is working, and when the candle comes near one of the leaks its flame is blown sharply.

Checking auto body seal against drafts. When air is drawn out vacuum gauge tells at a glance whether too little or too much air leaks into car

Camera the Size of Your Finger Holds Fifty Exposures

One of the world's tiniest cameras is the precision instrument made in England, which, although it is no larger than your finger, holds a film load of fifty exposures. Its shutter speeds range from "time" to 1/1,000 of a second. Automatically in focus for distances from six feet to infinity, it can be focused manually for objects as near as eight inches. There is a built-in filter which is brought into position by sliding, and returns automatically after the exposure. The camera has an f3.5 lens with a focal length of fifteen millimeters.

Despite its size this camera carries a load of fifty exposures and has 1/1,000-second shutter speed

Grease Carried in Paper Bag Coated with Nylon

Grease or oil can be carried in a paper bag, if the bag is coated with nylon, according to a patent issued recently and assigned to E. I. du Pont de Nemours and company. Nylon, made basically from coal, air and water, combines superior elastic, adhesive and greaseproof and waterproof qualities. When it is pressed into paper, leather, cloth and wire mesh, the result is oilproof paper, patent leather that resists cracking, waterproof clothing which is flexible and long-wearing, and a transparent wire-mesh window glass transmitting ultraviolet light.

GOLDEN FLEECE

WOULD you like to raise wool in your back yard, and go into the business of producing the "softest thing on earth"—for a good profit? You can, and you don't need more than fifty dollars to start in America's newest animal industry.

The animal is the angora rabbit, that animated fur ball which produces the wool for angora sweaters, mittens, jackets, and a hundred other warm and attractive garments. Tests have shown angora wool is not only the softest thing on earth, but also the warmest of animal fibers.

In 1933 a California rancher spent his last thirty-five dollars for a pair of angoras and the construction of a hutch and shearing stand. This year his rabbitry was one of the largest in America, with more than 1,000 rabbits. His monthly profit during 1939 was $200.

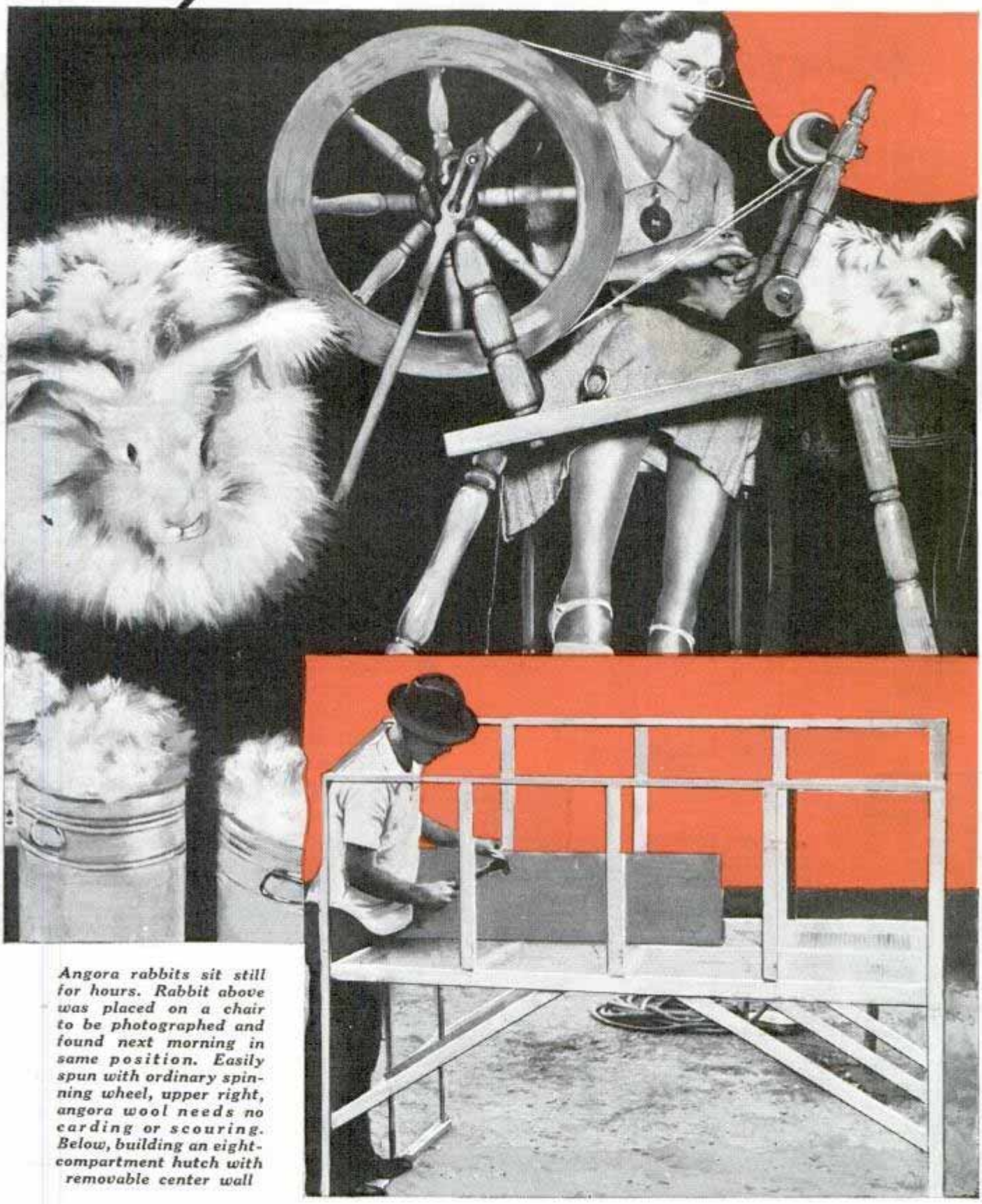
Until seven years ago, all angora wool was imported from England and France to be spun and woven in American mills. But in 1934 American-raised angora began to replace foreign wool. Starting originally on the west coast, angora raising has now spread to almost every state. Cold weather doesn't bother angora rabbits, as the wool is just as warm on them as it is on humans.

At upper left, the start and finish—an angora rabbit ready for shearing and sweater knitted of home-spun angora wool. Right, marking ear with indelible ink for identification, and (below) shearing wool

Recently devised methods of spinning the yarn and weaving the garments have eliminated the problem of "shedding" or rubbing off of fuzz. The result has been an immense increase in the demand for angora goods. America consumed $84,000 worth of angora wool in 1934, $800,000 worth in 1938. Moreover, the revival of interest in knitting has increased the sale of angora yarn many times.

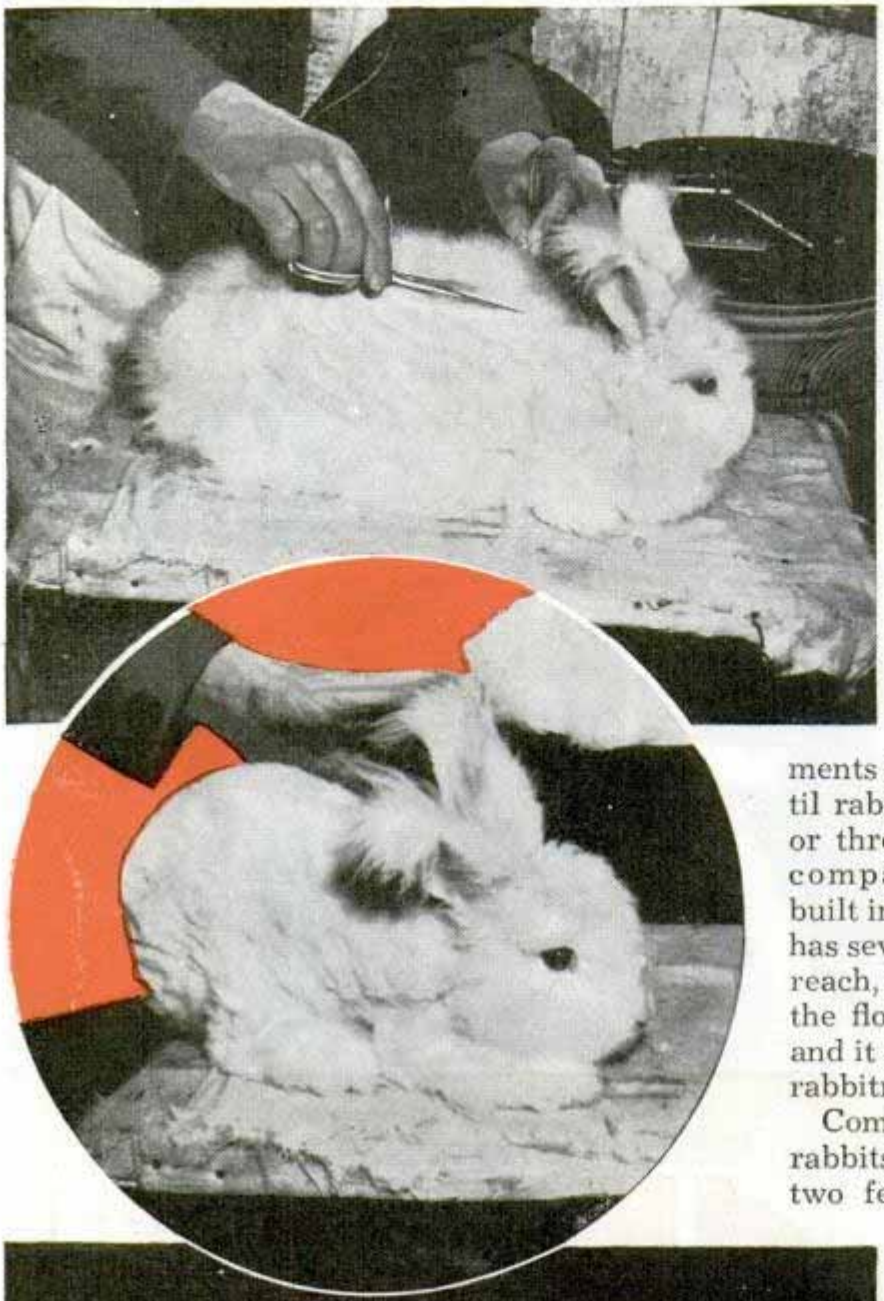
Starting with a good breeding doe rabbit and a buck of good ancestry, a back yard

in your BACK YARD



Angora rabbits sit still for hours. Rabbit above was placed on a chair to be photographed and found next morning in same position. Easily spun with ordinary spinning wheel, upper right, angora wool needs no carding or scouring. Below, building an eight-compartment hutch with removable center wall

rabbitry should have a herd of fifty rabbits within a year. A good doe should cost about fifteen dollars, a buck ten dollars. Rabbits are weaned seven to eight weeks after birth. At that time they are given their first shearing. This, however, produces only a small amount of wool. The first good crop of wool is sheared three months after weaning, or four and a half to five months after birth. Rabbits are



In shearing, top, one side is cut at a time with ordinary barber shears. Center, the finished shearing job; ears, feet and head of angoras are never trimmed. Bottom, a small nail keg forms nest for a breeding rabbit, the animal building its nest of straw and its own wool

sheared every three months during their mature lifetime, which averages five years. A good angora, doe or buck, will produce a pound of wool a year. At present, unspun wool brings from three to five dollars a pound at the mill. Angora growers can also spin their wool into yarn.

Although angoras are grown essentially for wool, they also make excellent eating. Therefore, bucks not needed for breeding, or rabbits whose wool production is below standard, may be sold for meat.

Full-grown rabbits require separate compartments in the hutches; however, until rabbits reach breeding age, two or three may be kept in the same compartment. Hutches may be built in tiers, but a single-tier hutch has several advantages. It is easy to reach, no trough is needed under the floor mesh to catch droppings, and it is easy to transport about the rabbitry.

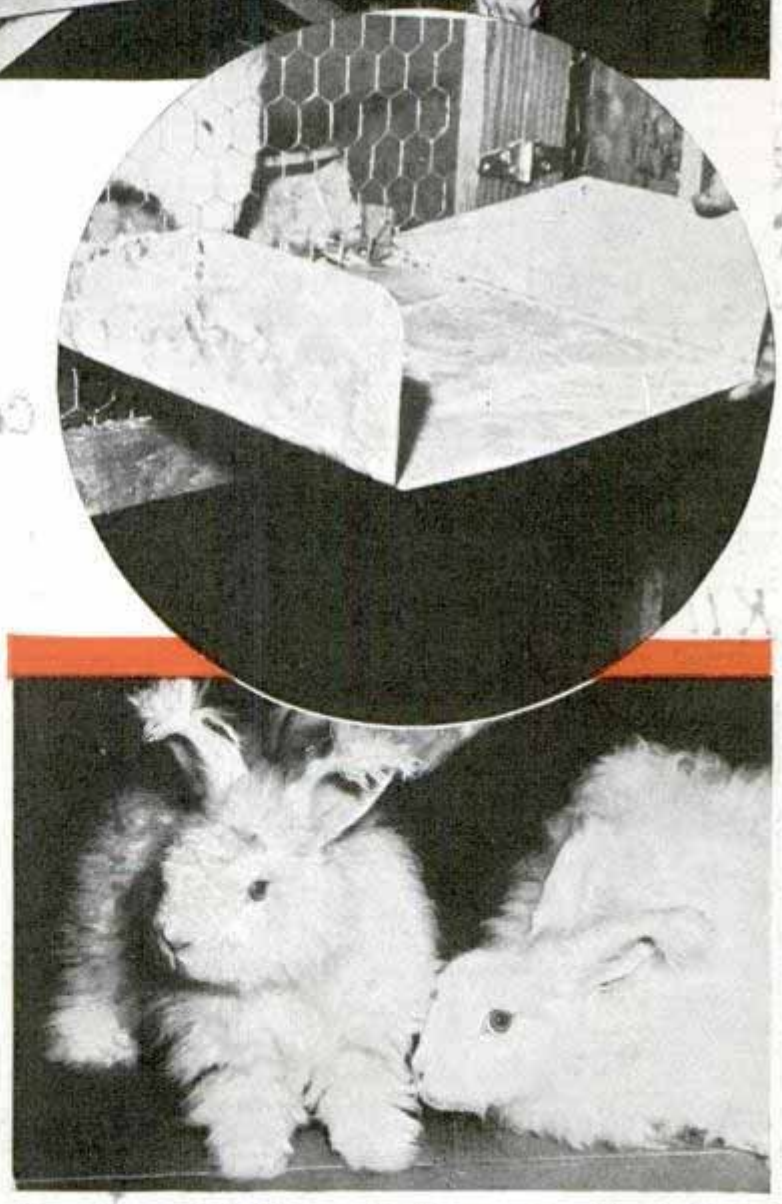
Compartments for wool-bearing rabbits should be at least two by two feet; breeding compartments, two by four. A removable partition between compartments allows them to be converted easily into breeding compartments.

Frames for the hutches should be of two-by-two inch or heavier stock, the sides being poultry netting. As the rabbits have a habit of chewing the wire, it has been found advantageous to use galvanized iron sheeting to a height of one foot on the sides and back. The floor should be of five-eighths-inch hardware cloth or three-fourths-inch wire netting. The roofs, hinged to allow access, should be of wallboard or similar material, covered with tar paper. Leaking roofs are dangerous, as the

angoras are prone to catch cold in damp hutches. A hutch can be built with any number of compartments. Four is a convenient number. When built on a double plan, with compartments on both sides of a galvanized-iron center partition, this makes a unit of eight wool rabbit compartments, four breeding compartments, or any combination of the two. In mild climates rabbits may be left out of doors the year around, provided the hutches are protected from rain. In cold climates it is necessary to have sheltered hutches for animals freshly sheared. Rabbits are successfully raised in Canada.

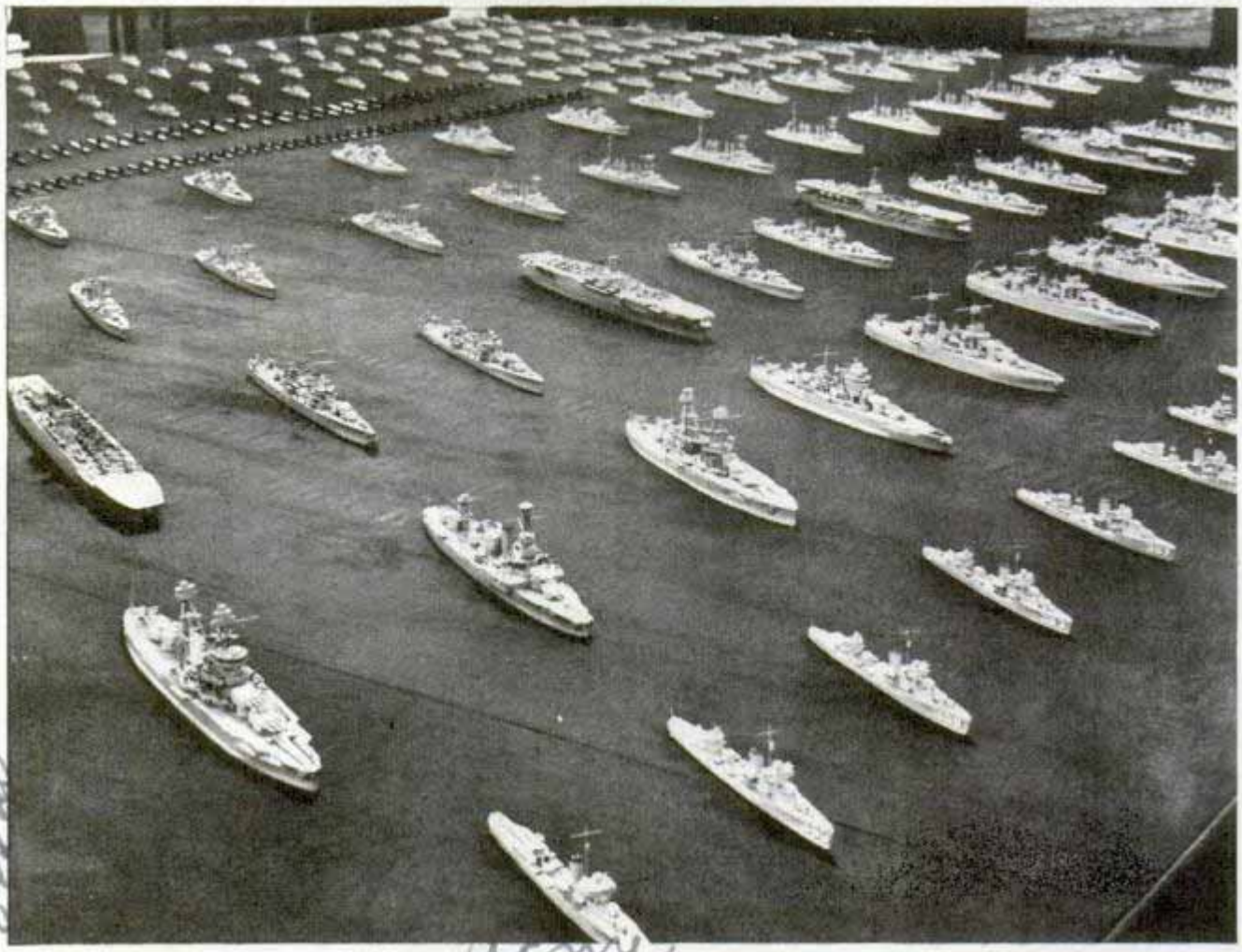
Rabbits should be fed once a day. Feeding trays can be made from galvanized iron. To provide a water supply, a six-inch crock should be placed beside the feeding tray, held in place by clips or cleats to prevent the rabbit from moving or overturning it. The principal diet of angoras should consist of alfalfa or clover hay and grain, or commercially prepared pellets embodying these ingredients. Rolled barley, oats and wheat are good grains for rabbit

(Continued to page 159A)



Top, homemade hutch completed except for hinged plywood roof which is covered with tar paper to exclude dampness. Galvanized iron feeding trough, center, swings down for cleaning. A pair of good breeding rabbits (bottom) should cost about $25

Whole United States Navy Shown in Miniature



Lined up for review on a huge table, scale models of United States fighting ships give the beholder an eyeful of the navy which would be virtually impossible on sea because of the vast area fleet would cover

What our first line of defense would look like in one grand assembly is indicated by a group of models recently displayed at Washington. The miniature battle fleet, built to a scale of fifty feet to an inch, is the work of Charles A. Gunther of Richmond Hill, N. Y. It comprises an array of fighting ships including aircraft carriers, battleships, both heavy and light cruisers, destroyers and submarines.

Disk Knife Cuts Corn at Stem and Makes Shucking Easy

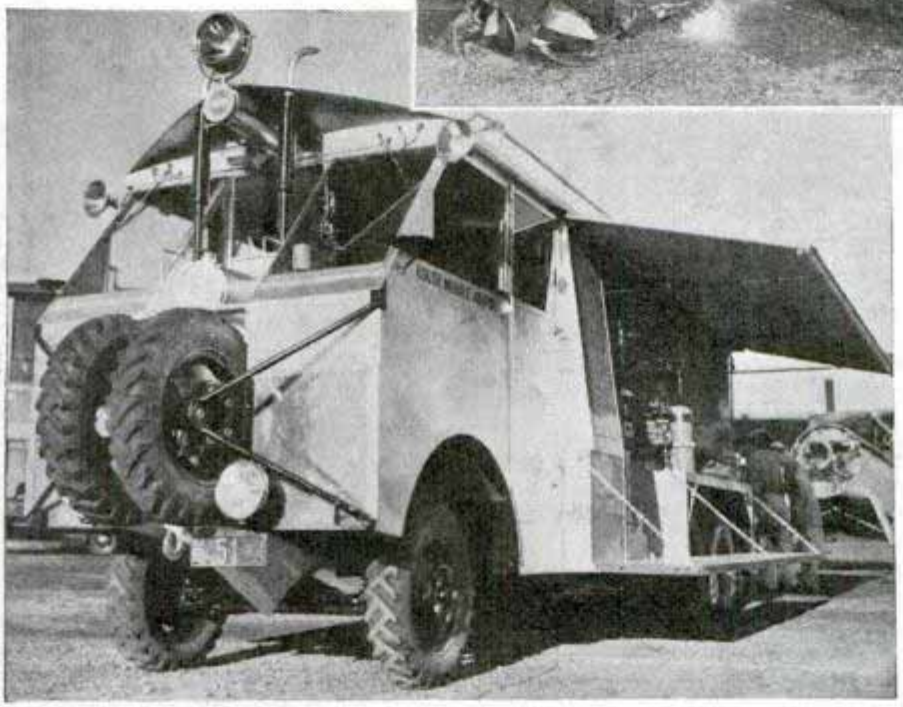
Knife severs hull at base for quick and easy shucking

Corn shucking is made fast and easy with the aid of a disk knife that severs the end of the shuck so the ear may slip out. The disk cutter is pivoted off center and passes through a slot in the base when driven downward by the long handle. Operation is simple. Held in the left hand an ear of corn is placed under the blade, which is brought down with the right hand. After the shuck has been cut off at the base, it is raised upright and the ear drops out of the shuck as from a shell.

¶Copper-bearing cement recently developed for structural uses is weather-resistant and can be sprayed, brushed or troweled on any building material.

'Airport on Wheels' Carries Shop and Lights

Any cow pasture can be transformed into an emergency airport on short notice by taking to it a complete service shop on wheels, called a mobile airport, equipped to make permanent repairs to damaged airplanes, motor trucks, engines and machinery. In war it permits the shifting of landing fields overnight, and several units have been ordered for use in France, many smaller "traveling shops" already having been shipped to China. Weighing 26,000 pounds, the "airport on wheels" carries a lighting system for the airport, power lathe, drill press, carpentry shop, a two and one-half ton boom rigged on top for lifting motors from planes, welding apparatus, and two-way radio. The engine that runs the six-wheel drive also drives the generator to operate floodlights and all of its equipment, as well as to recharge batteries, if no outside current is available. Two spare wheels, mounted at the front, act as a bumper in pushing planes around the field. When the shop is in use the sides open outward providing overhead shelter for the workmen. A three-man crew can operate the unit. For convenience in shipping it or transporting it over unsafe bridges, the mobile airport is constructed so it can be taken apart in small sections and assembled again quickly.



Above, sides of mobile airport are swung out; one man works in shop while another welds. Left, workmen at rear repairing plane in background

Super Gasoline Found for Planes but It Must Be Injected into Engine

Interest in safety fuels for airplanes has been revived by development of a new type gasoline that has a flash point of 100 degrees Fahrenheit—the temperature at which its vapor will ignite—yet has an octane, or anti-knock, rating up to 100 octane number. Scientists of Standard Oil development company state that if proper equipment were installed, it would be possible to produce 10,000,000 barrels of such fuels each year, enough to meet aviation's needs for years to come. These fuels, however, cannot be burned in an ordinary engine using a carburetor, since it is necessary to feed the new gasoline into the engine by injection methods.

FOG of

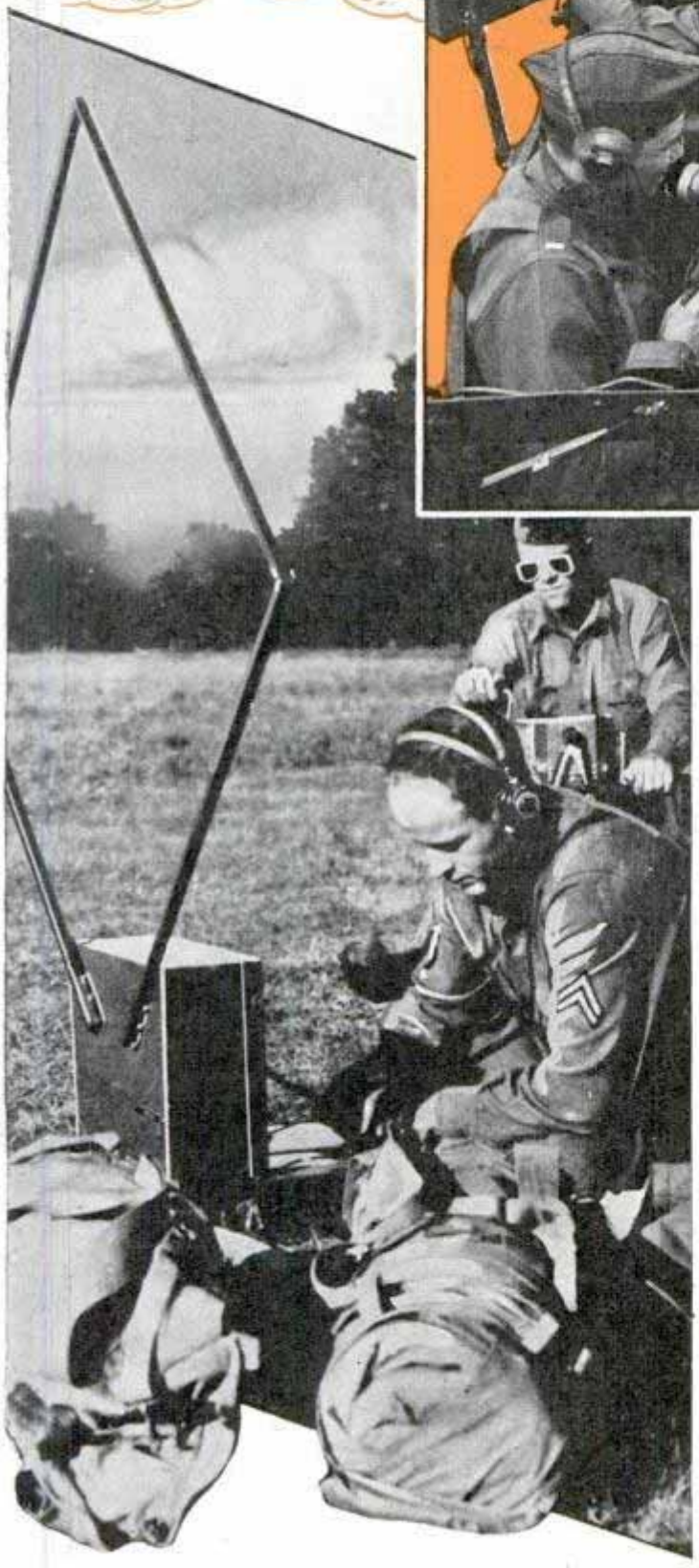
Defense staff, top, studies maps while coordinating information in war games. Center, mottled camouflage blends bomber into landscape. Pack radio, below, keeps commander in touch with his scattered troops

TO THE layman war means bayonets, bombs and bullets. The real war, as waged by successful commanders, is a matter of confusing, deceiving, blinding the opponent, so he will not know where the bayonet, the bomb and the bullet will strike. It is a matter of probing and spying, of efforts to pierce the fog the enemy throws out to blind him.

The real war is a matter of censorship, of camouflage, of invention and counter-invention, of patrols and reconnaissance and codes, of everything to deprive the enemy of information, of everything to obtain information for

WAR

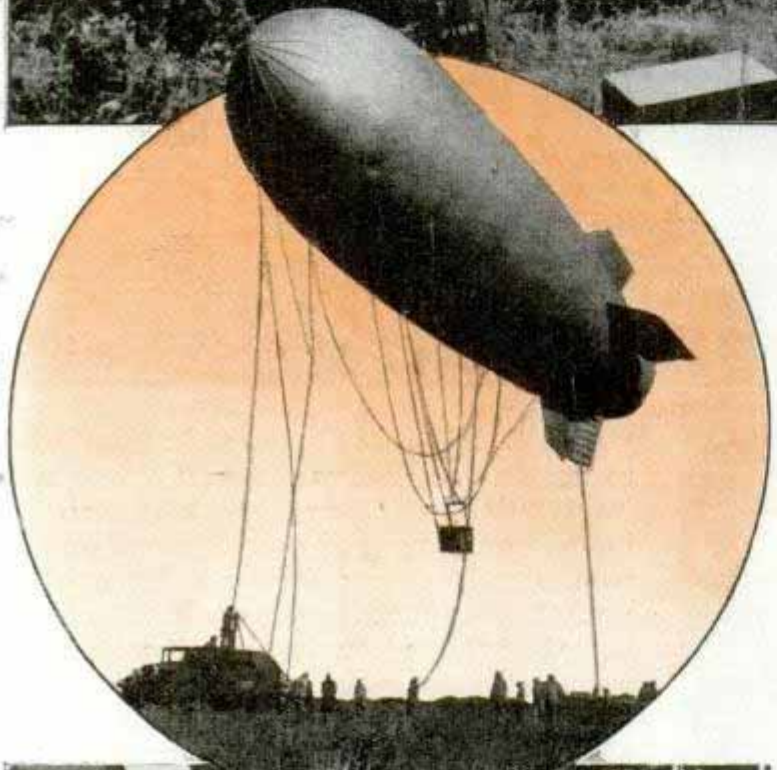
Reconnaissance car, right, is armed to fight as it gathers and radioes information. Below, directional loop antenna intercepts enemy radio message

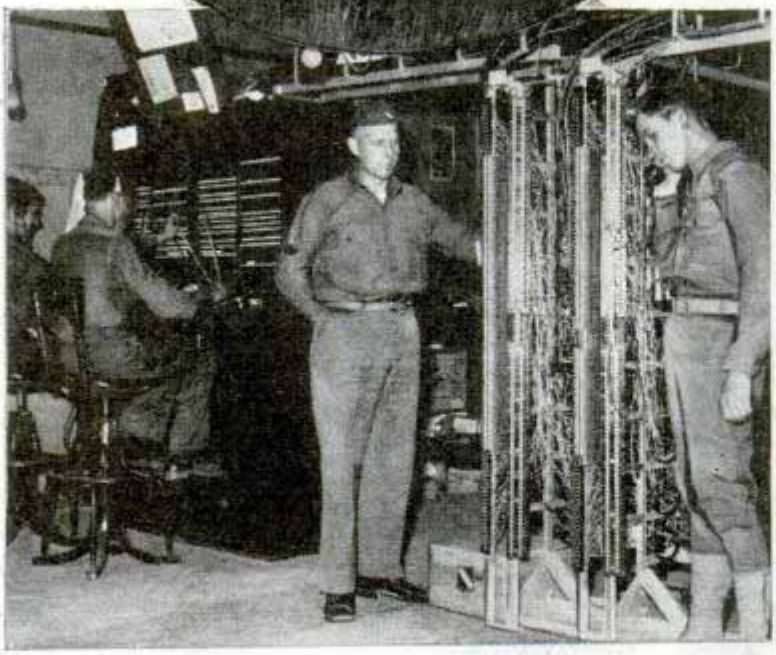


yourself. Thus we find that brilliant victories are invariably the result of superior information; disaster usually can be blamed on the fog of war. A blind man is woefully handicapped in a fight; a blind army is even more helpless. The lightning defeat of Poland drove this obvious truth home with startling force.

Western Poland is a vast, almost treeless plain, offering scarcely any cover for massing armies. The German air force, with ten-to-one superiority, quickly drove Polish planes from the sky. Then, operating unmolested, they could report every Polish troop movement. German generals could choose whether to march around the enemy, or confront him at any point with overwhelming numbers. And the blinded Polish generals had no information with which to counter these moves. Never has this bewildering fog of war closed down so completely on one side, been dissipated so expertly for the other.

When the Wright brothers invented the airplane, they developed more than a flying machine. They developed a long-range eye, one that could fight. Seeing all, yet depriving the enemy of sight, the airplane made it possible to defeat the Polish army of a million men in four weeks.





At top, a seventy-five millimeter battery camouflaged under nets and foliage. In circle, an observation balloon goes aloft. Bottom, divisional communications center during maneuvers

When Marconi invented the wireless telegraph, he made possible the battle of Tannenberg, the easy defeat of Russia by Germany in 1914-1915. Telegraphic communications were poor in Russia, so orders were sent by radio—in code, of course. One Russian general had not received the new code, so asked that a message be repeated. A stupid operator repeated it in plain language. Both messages were intercepted in Vienna, making the whole code known to Austrians and Germans. The fog of war on the eastern front immediately lifted for the German commanders. Thereafter they received the Russian orders as soon as did the Russians, maneuvering their smaller forces to defeat the Czar's armies.

Bushnell and Fulton and Holland invented invisibility when they developed the submarine. With this weapon, which utilizes the fog of war more fully than any other, Germany almost won the first World War.

In April, 1917, submarines were sinking nearly a million tons of merchant shipping a month. Simple arithmetic showed that if sinkings continued at this rate, the starvation point would be reached in England in November of that year. The war lasted a full year after that date, and Germany lost,

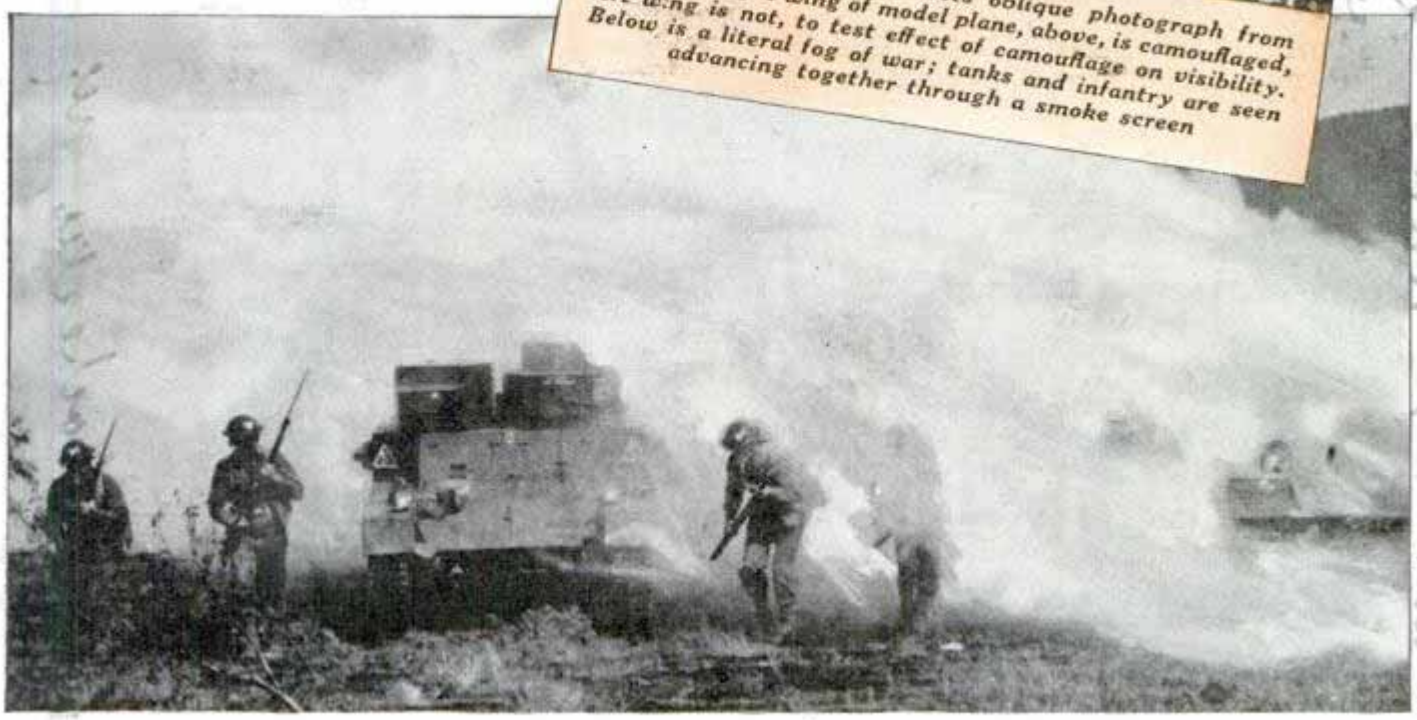
her submarine campaign reduced to the status of futile annoyance—a status it appears to have regained in today's war.

For the British and American navies pierced that fog of invisibility. The British secret service became successful in reporting each time a submarine left its base, which one it was, its commander, and other pertinent information. Thereafter, by intercepting the submarine's radio messages, and from reports of her attacks, they were able to plot the approximate location of every submarine each day. Merchant shipping was placed in destroyer-protected convoys, whose courses were changed daily by radio orders to steer around submarine-infested areas.

Then in October of 1917 American inventors developed the hydrophone to the point where it could detect a sub's propellers twenty miles away and accurately indicate its direction. Destroyers then could find the submarine and sink it.

(Continued to page 122A)

Army cameraman, top, shoots oblique photograph from the sky. Right wing of model plane, above, is camouflaged, left wing is not, to test effect of camouflage on visibility. Below is a literal fog of war; tanks and infantry are seen advancing together through a smoke screen



Photos from U. S. Army Signal Corps and U. S. Army Air Corps

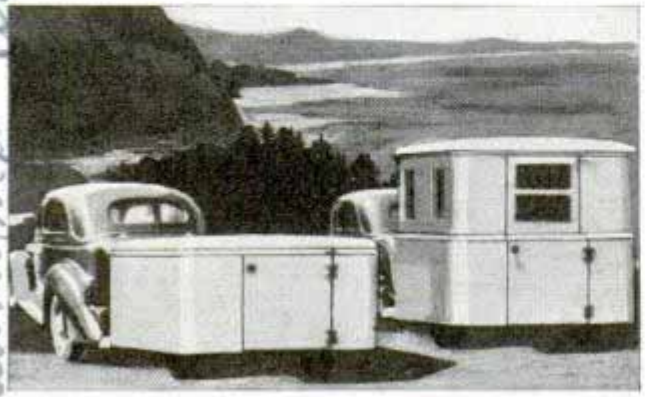
Mobile X-Ray Unit Plugs In at Bedside of Patient

Patient too ill to be moved from bed is given X-ray treatment with portable machine

X-ray treatments for patients too ill to be moved from bed are made possible by the development of a portable unit, entirely self-contained, which is ready for service the moment it is plugged in at the outlet nearest the bedside. It is flexibly mounted so that radiation can be directed easily to any part of the body. The unit operates between sixty and 140 kilovolts.

Trailer with Telescoping Roof Forms Six-Foot Home

Its top portion telescoping downward into the bottom section, a house trailer does not obstruct the driver's rear vision while on the road, and becomes a livable home with headroom of six feet and one inch when raised. The single wall of the upper part slides down between an inner and outer shell forming the bottom wall, which is sealed and insulated to conceal all windows and doors from mud and weather. In this position the trailer is only fifty-two inches high, which is lower than the rear window of the car, allowing a better view for driving and backing into a parking space, besides cutting its top-heaviness and wind resistance. Raising and lowering the top is accomplished by four jack screws that work together, one in each corner, and either a starting motor or hand crank may be used. When the top is up, the dead air space between the two shells at the bottom serves as insulation.



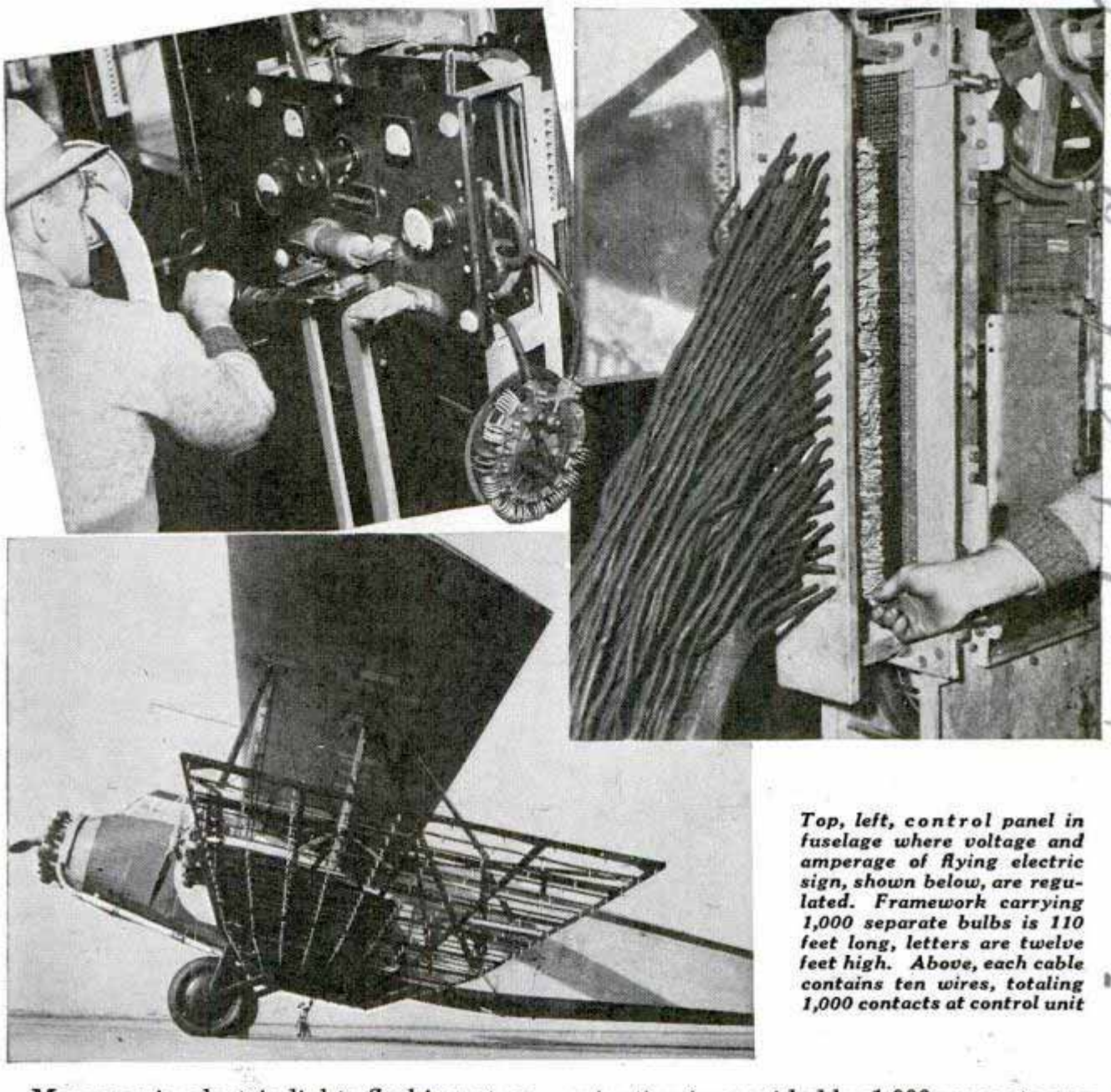
Trailer, at left, has top telescoped downward while being towed, and at right it is opened to full height

Telescope Mount for Car Window Allows Its Use from Seat

Motorist uses telescope from auto in comfort, with instrument mounted on support that fits window

Automobile tourists and sports spectators may view distant scenes through a telescope, while seated in their cars, by mounting the instrument on a support, now available, which is attached to the top edge of the window. In observing birds along the road, watching the progress of events such as shooting matches, or merely getting a close-up view of the landscape, motorists find that the support permits higher powers to be used than when the instrument is held in the hands. The special mounting slips snugly over the lowered window and the telescope is adjustable to any position for sighting objects, since it has the same shaft and cradle that is used on the manufacturer's telescope tripod.

Flying Electric Sign Writes Message in Sky



Top, left, control panel in fuselage where voltage and amperage of flying electric sign, shown below, are regulated. Framework carrying 1,000 separate bulbs is 110 feet long, letters are twelve feet high. Above, each cable contains ten wires, totaling 1,000 contacts at control unit

Messages in electric lights flashing at an altitude of 3,000 feet from a huge flying signboard are read easily by persons on the ground. The letters are twelve feet high, and words travel at reading speed across a 110-foot framework suspended below the wing of a transport plane. Illumination is provided by 1,000 separate gas-filled electric bulbs constructed to permit rapid on and off lighting. Since each lamp is regulated individually through a direct connection with the controller unit in the plane, the entire installation required more than 75,000 feet of wire.

Rate of Heartbeat Indicates Probable Span of Your Life

If you are in good health and your heart beats about seventy-two times per minute at early middle age, you have a better average chance of long life than your neighbor whose heartbeat is faster. That is the finding of doctors who examined cases of 2,332 adult males on insurance company records. Searching for one difference between long-lived and short-lived groups that would be constant for each, the investigators found that heartbeat rates of the short-lived, regardless of the cause of death, averaged higher than those of the long-lived group—in some cases as much as three beats a minute. This, however, indicates only that the average expectation of life for all persons with fast heartbeats as a group is less than for those with slow-beating hearts, and any person may be an exception to the average.

CHAMPIONS in the

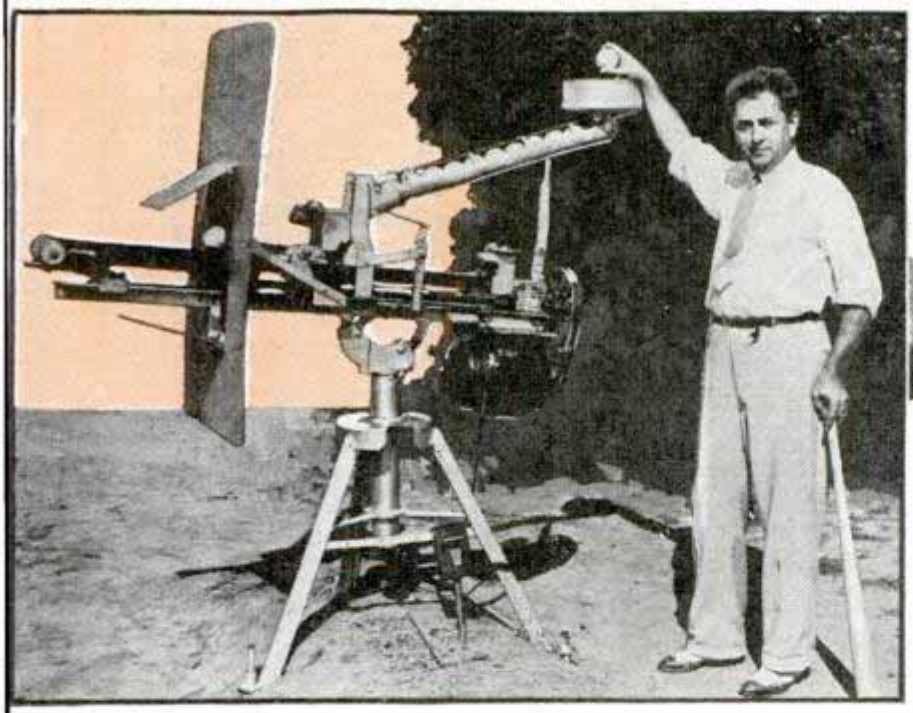
Spring training includes patient practice to harden the player for hitting the bag, top. Below, Gabby Hartnett of Chicago Cubs at batting drill

INVENTED a hundred years ago, baseball today is America's most popular sport, and in its development as a highly intensive contest of skill, science and mechanics play an increasingly important role.

Science enters into the training of the players in the big leagues. The field of mechanics is utilized in a number of devices whose purpose is to enable the player—and the team as a whole—to arrive at the highest possible point of ability.

It is in the spring training camps that rusty bodies and minds are oiled up for the coming season. The veterans work back into their accustomed smoothness, and the rookies are taught the

There is terrific strain on the arm in throwing a fast ball, demonstrated at right by whiplike fling of Cliff Melton. Below, Chicago Cubs bombard their veteran catcher-manager, Hartnett, with a half dozen balls at once. Bottom, Byron Moser demonstrates mechanical pitcher he invented for batting practice

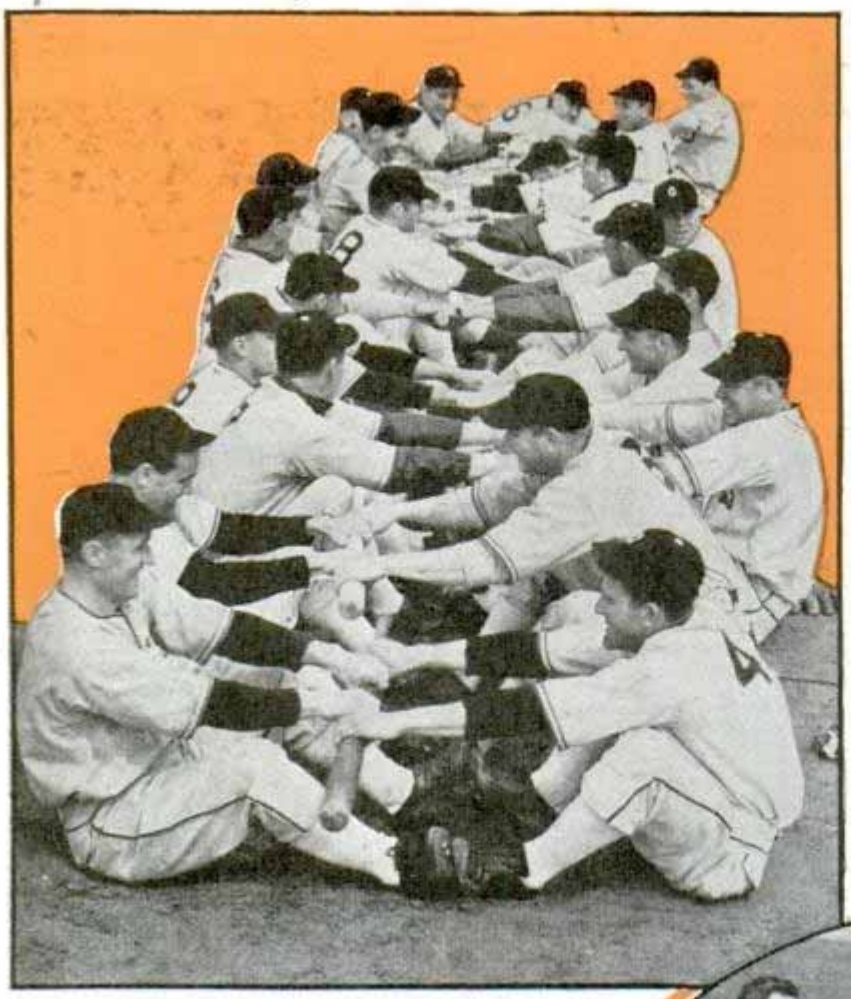


MAKING

things that win league pennants and world series. Calisthenics are always a part of the program, including much running, limbering up exercises, juggling the medicine ball, and tossing baseballs back and forth to sharpen reflexes and quicken action. Winter-accumulated weight sometimes has to be sloughed off, and players' "wind" improved.

Every player goes through a course of training in the fine points of playing the game, with special attention to the position he will hold during the season.

Another important function of the spring camps is the opportunity they give for correcting faults in the players. Bob Feller, Cleveland's young pitching sensation, was discovered taking too long a stride when making his delivery. On the advice of the coaches he shortened his stride, and found that it gave him a



Top, working kinks out of muscles. Below, to develop agility, Hartnett tosses the ball where the other fellow (Dean) isn't

"Watch a base runner and notice how he sidles away from the bag without passing one foot with the other. That isn't an accident. He has been taught to do it that way—not to pass the right foot with the left when leading off base. In this way he is always ready to give himself a quick push with the right foot back to the bag if the pitcher tries to catch him off base."

The hook slide gets much attention in the camps. The player is taught to slide in the opposite direction from which the infielder is handling the throw. The front knee is bent and the foot kept off the ground, to prevent injury. The feet-first slide, universal today, insures greater freedom from spike injuries than the old-time head-first slide, and also makes it more difficult for the baseman to tag the runner.

marked increase in power and control.

Roy Bell, big league outfielder was batting .250 when he was with the St. Louis Browns under Rogers Hornsby. On the advice of Hornsby he emulated the Hornsby style at the plate —back from the rear corner of the plate, coupled with a long-range swing—and his batting average jumped to .350, in addition enabling him to belt them all over the park, instead of mostly into left field, as had been the case.

Lew Fonseca, himself a major league star for more than a dozen years, and now promotional manager for the American League, says: "I'll never forget what Burleigh Grimes said to me once. He was talking about batting, and he stated that in his years as a big-league pitcher he had observed that the most consistent hitters never moved their heads after they got set at the plate. They kept their eyes on the pitcher, and they got more hits than those who let their heads and eyes wobble."

Of base running, Fonseca points out:

Pitchers are taught the cardinal rule of learning each batter's weakness, and then throwing him the kind of ball he will strike at with the least effectiveness. Control is striven for incessantly, since it means the pitcher will have to throw fewer balls in a game, with a consequent saving of his arm. If he doesn't already know it, the pitcher is taught that a "follow through" is all-important, and that the

right position for this is with the toe of his shoe that strides forward in making the pitch in a direct line with the plate and the hitter.

When it comes to batting and producing the hits that win games, the player is taught to stand neither too close nor too far from the plate; to use as little back swing as possible in batting, and to limit the bat to a little up-and-down motion before the pitch; to give plenty of effort at the finish with the arms and wrists; to keep most of his weight on the rear foot until after he hits the ball, especially when facing curve-ball pitching; to follow through with his swing, so that his body pivots halfway around, for adding distance and speed to his drives.

Catchers are taught to watch the batter constantly while the latter is up at the plate, in hopes of catching some move on his part that will indicate the kind of ball he is waiting for, or tip off the fact that a

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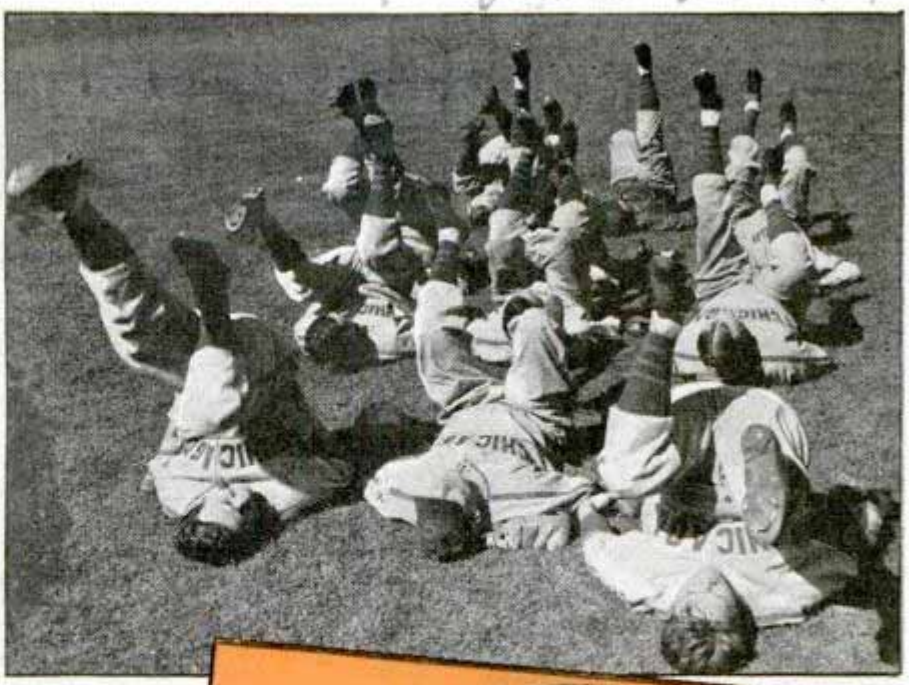
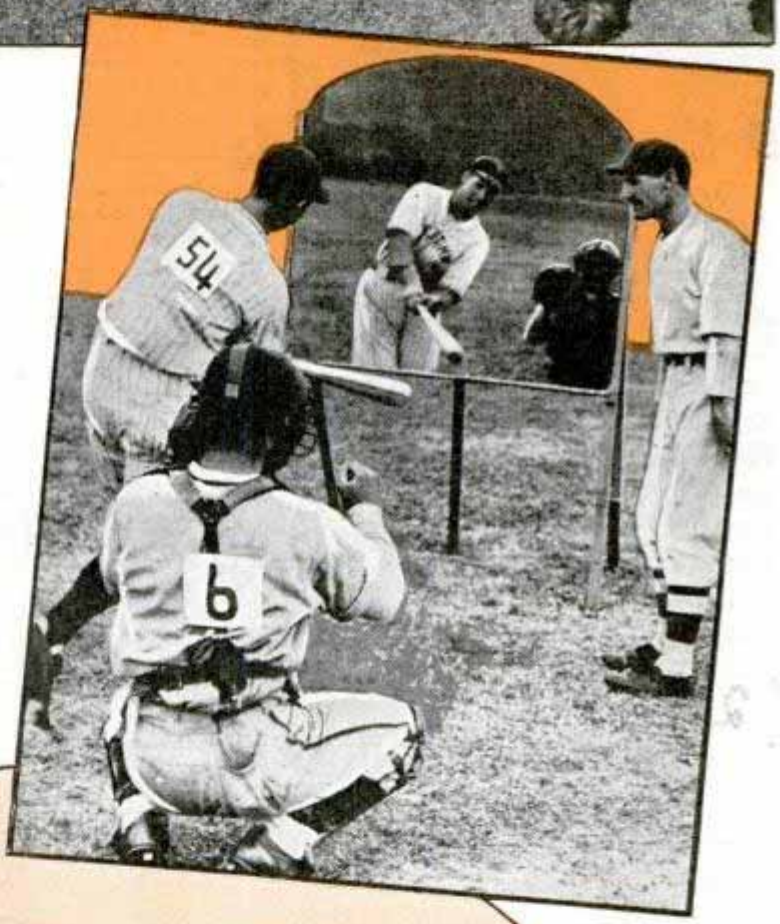
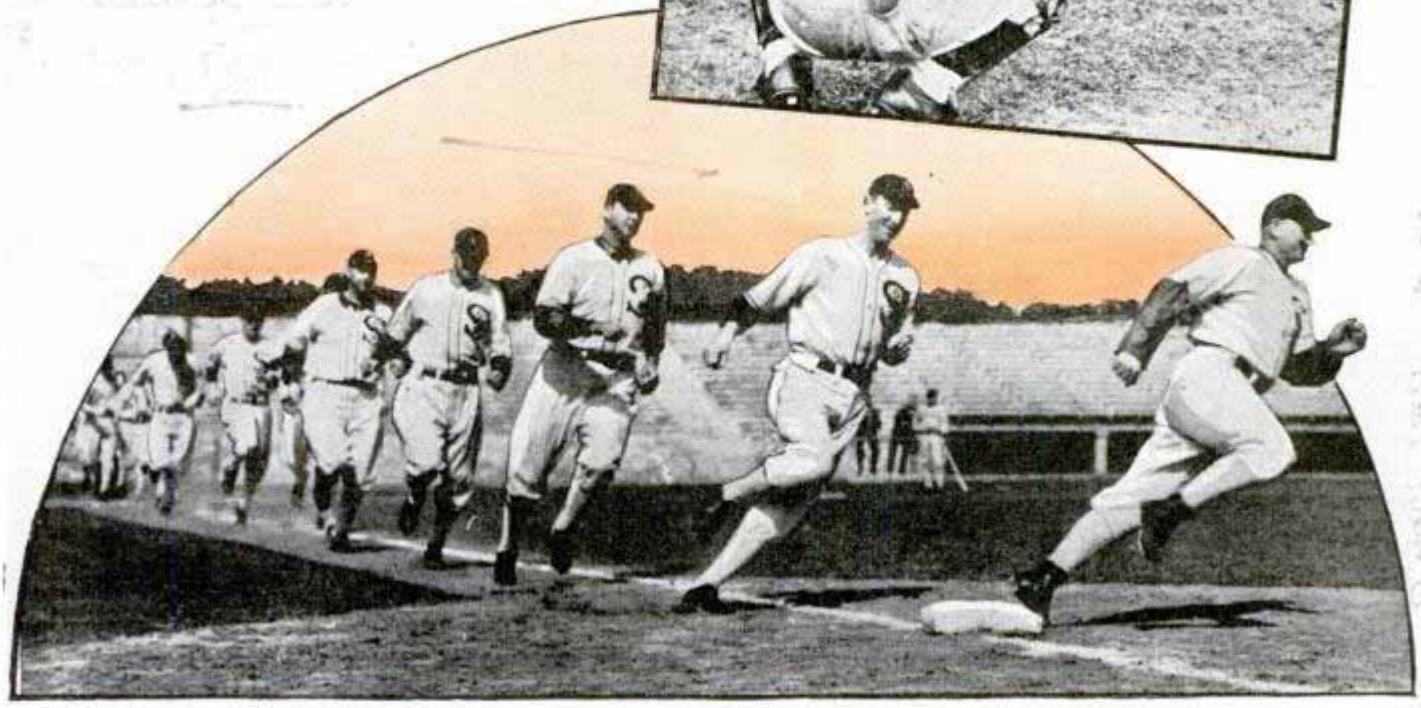
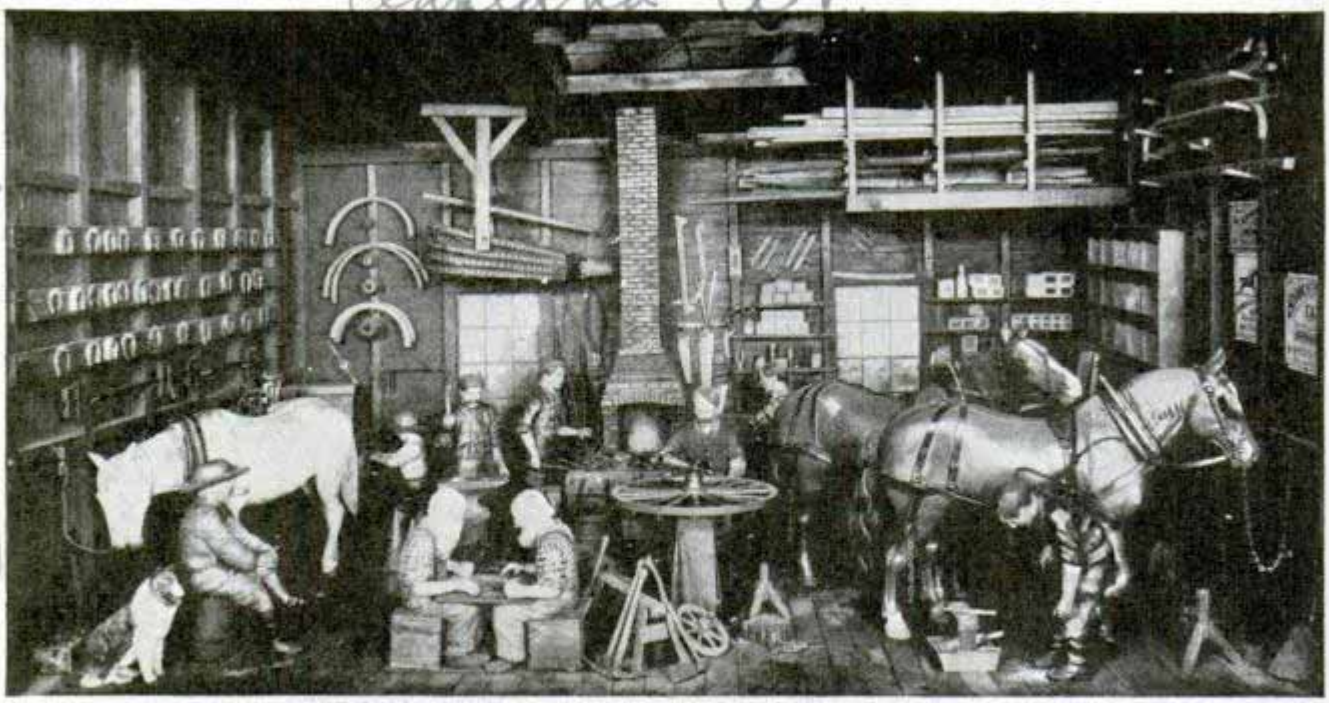






Top, limbering up with calisthenics. Right, Joe Stripp uses a mirror to show "rookies" the proper batting form. Below, members of the Chicago White Sox squad tour the bases at Pasadena's Brookside Park diamond

Smithy Model in Wood Depicts Famous Poem



Horseshoes, wagon parts and blacksmith tools decorate the walls of this animated smithy model depicting Longfellow's poem. Men, carved in wood, move realistically as they work at their various tasks

Longfellow's poem, "The Village Blacksmith," is depicted in wood by a Rhode Island carver who has whittled a likeness of the shop and animated it with lifelike figures. The entire tableau, which is five feet long, four feet high and three feet deep, was carved with a jackknife. The smith is shown filing the hoof of a horse, while another horse turns its head to look on. The carriage maker, putting a tire on the wheel, bores holes as it revolves. In the rear of the shop four workers are engaged, two at the forge, a third pumping the forge bellows, and the fourth pounding an iron that emits leaping sparks as the hammer descends. In the center foreground the village champion checker players raise their arms and pound the board in a heated argument over the game. At the left sits one of the village loafers with his pet dog whose moving tongue simulates panting. Horseshoes hanging on the walls along with other smithy trimmings make the model complete.

Tunnel Is Laid Like Pipeline to Save Army's Golf Course

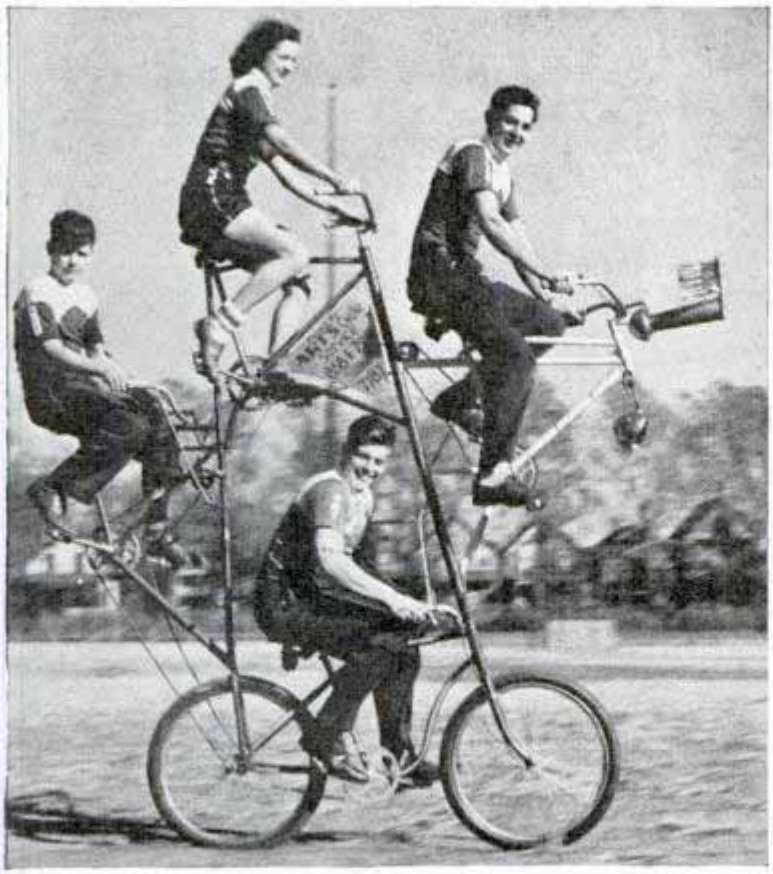
Highway engineers adopted the "open and cover" method, similar to that used in laying pipelines, in constructing a four-lane traffic tunnel through Uncle Sam's military reservation, the Presidio of San Francisco. The highway, which forms an approach to the new Golden Gate bridge, will save many motorists several miles of driving through heavy traffic. Unfortunately, however, its route runs directly through the golf course, used by army officers, that is built on fine, loose sand covered by a few inches of sandy soil. The idea of building a highway or an overhead approach was discarded as

Four-lane highway tunnel traversing golf course was built in deep ditch and later covered over in order to preserve park used by army officers

being dangerous to both golfers and motorists. On the other hand tunneling through loose sand would be hazardous and involve prohibitive expense. As a solution, it was suggested that a tunnel be constructed without tunneling, like pipelines are laid in deserts and other sandy regions. A ditch 2,000 feet long was dug through the golf course, and in the bottom of this ditch a tube with a diameter large enough to carry a four-lane highway started to take form. As each section of the tube was completed, it was covered with the sand from the ditch.

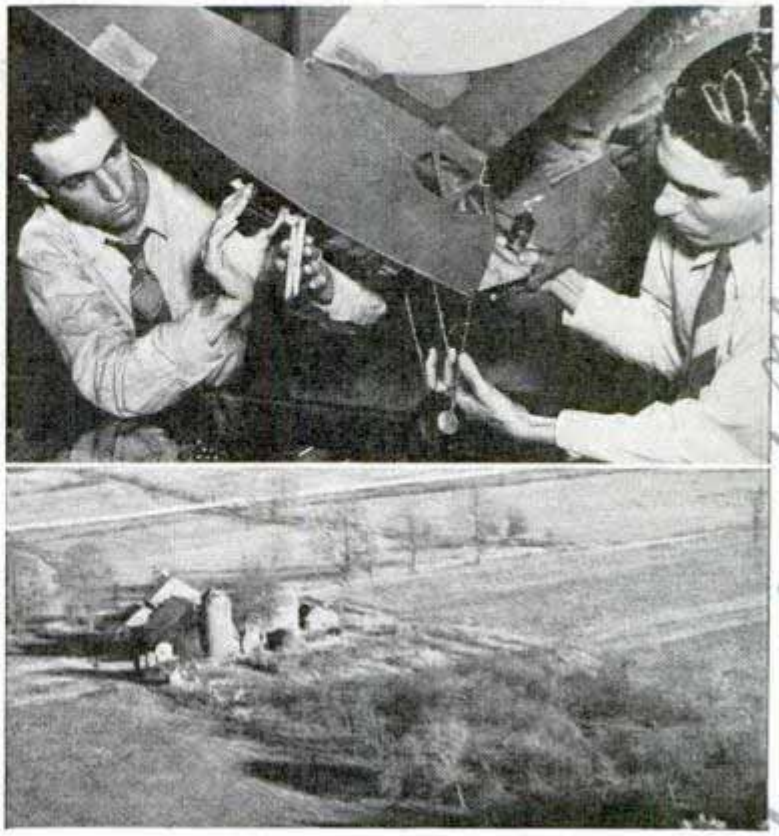
Ten-Foot "Tower Bicycle" Carries Four Riders

Four can ride a ten-foot bicycle built by a Chicago mechanic to use in parades and at public events. It is steered by the rider on the top seat, ten feet above the ground, and the others assist in the pedaling, power being transmitted through a series of double sprocket wheels. Operation of the 175-pound novelty is simple and easy.



Four-passenger bicycle, ten feet high, is pedaled by all through series of chains and sprockets, and top rider does the steering

Camera in Model Airplane Snaps Aerial Photographs

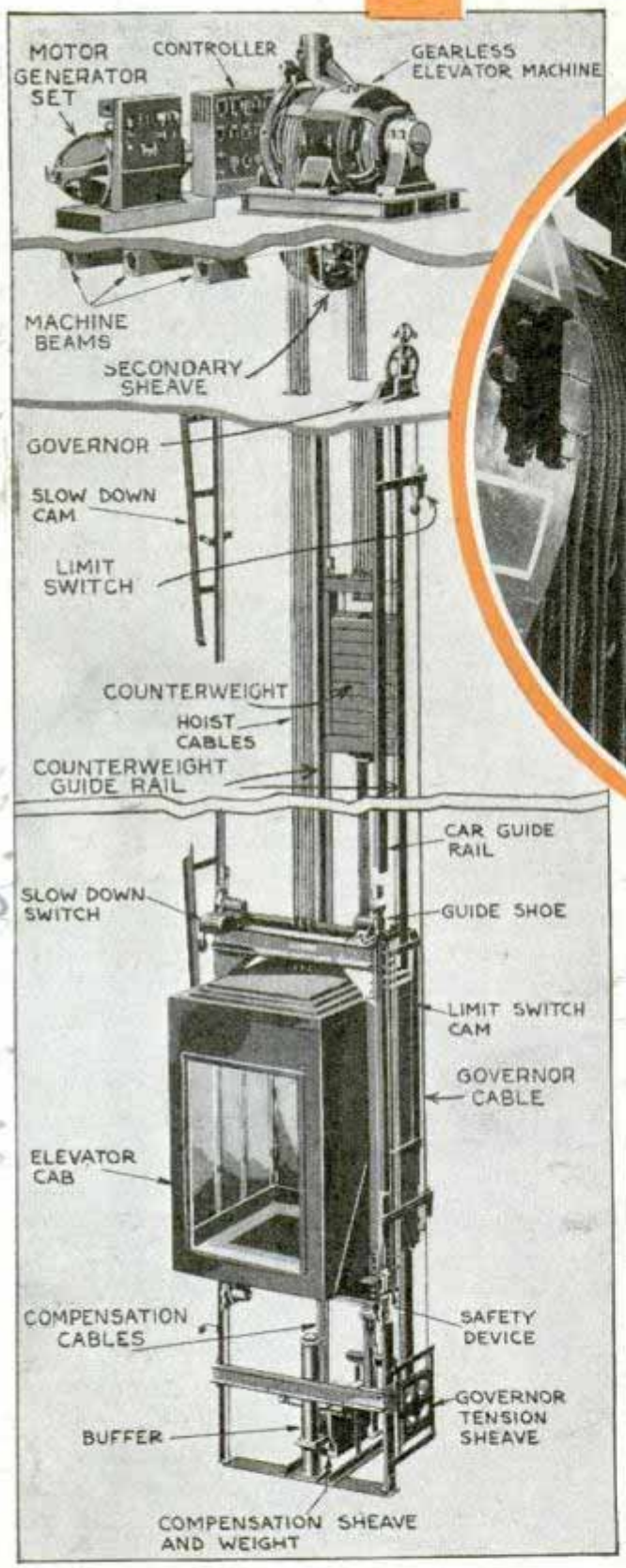


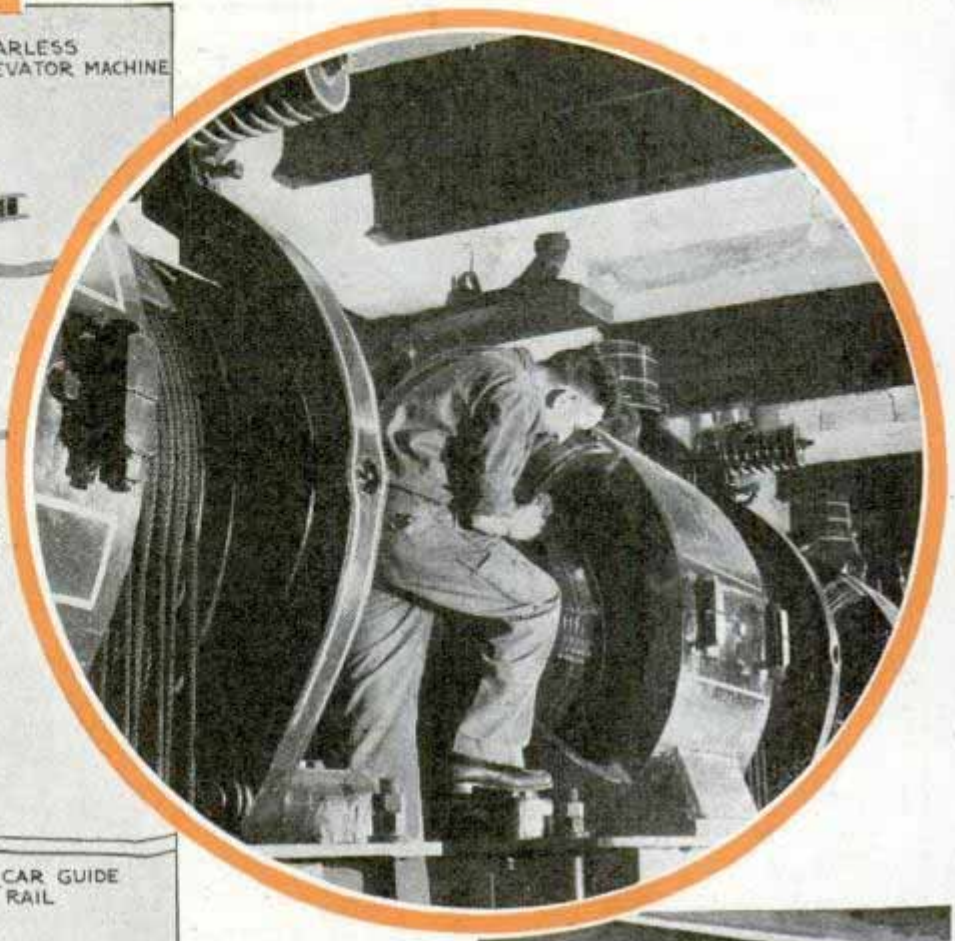
Top, preparing model plane for picture-taking flight. At bottom is aerial photograph made from height of seventy-five feet

Two youthful model-airplane experimenters have added photography to their hobby and are now taking aerial pictures from their pilotless craft. To compensate for the weight of the camera which is placed in a trapdoor beneath the fuselage, two of the landing wheels have been removed from the ship. Photographs are taken from about seventy-five feet up, and since the craft cannot be controlled from the ground it is set to fly a circular course, the usual flying time being fixed at forty seconds. The timer that cuts the motor for landing also automatically opens the trapdoor and releases the shutter after the plane has started to settle and vibration ceases. The ship used has a wingspread of six feet and its gasoline motor is one-twenty-fifth horsepower.

¶Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped envelope.

STEP SAVERS





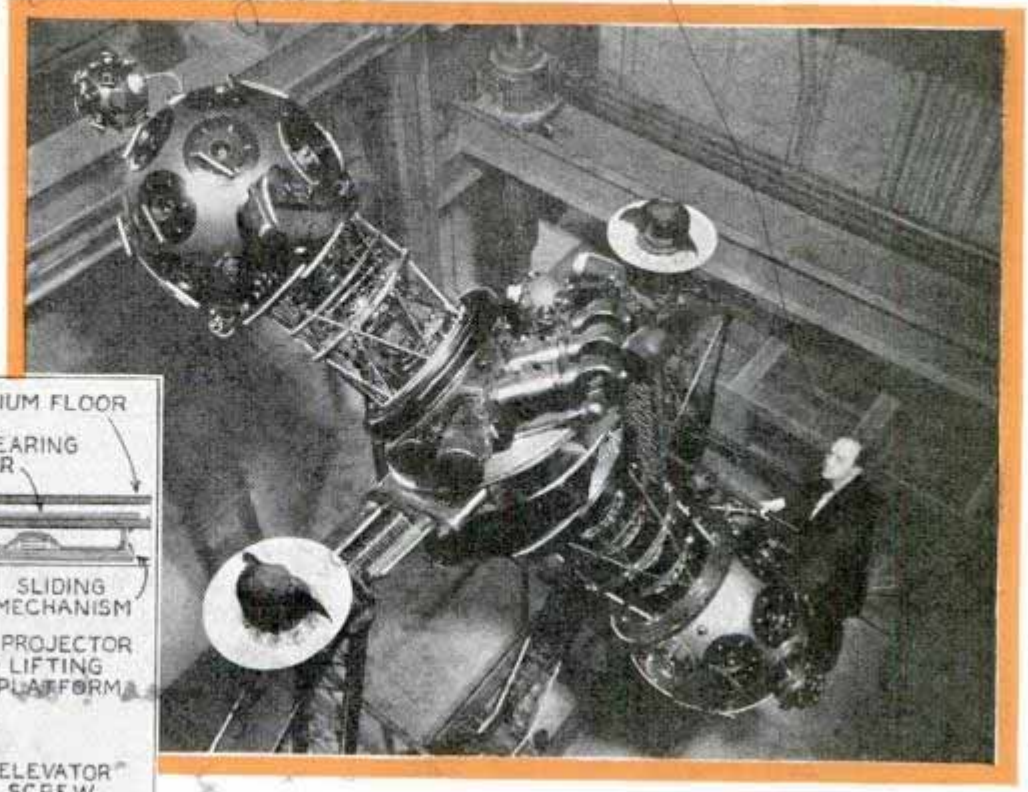
Left, drawing of essential parts of typical gearless-traction passenger elevator. Circle, working on sheaves and cables capable of hoisting 30,000 pounds of equipment. Bottom, view up hoistway of RCA building in New York

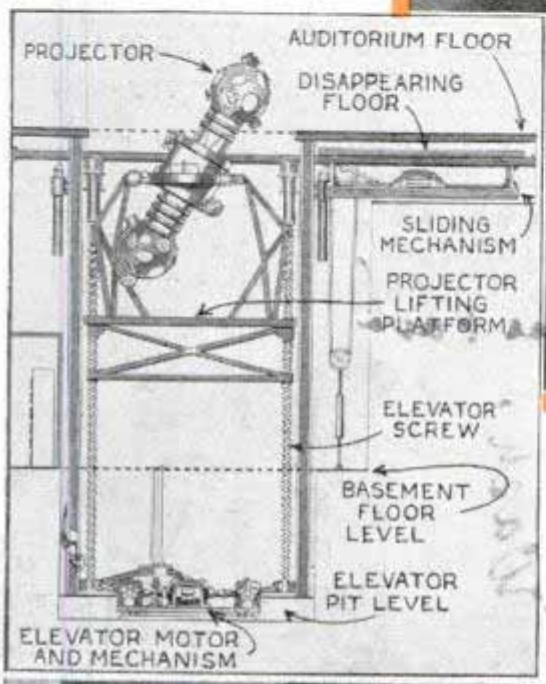
TWENTY-FIVE billion passengers a year ride this country's elevators at speeds up to sixty-five stories in slightly more than three seconds. In the most modern cars, this up-and-down transportation is virtually automatic, as well as safe and comfortable.

Automatic controls, which can "think" and act more dependably than a human being, do most of the work. As you

for MILLIONS

Right, Buhl Planetarium projector rides elevator to shooting position. Below, sketch of system. Bottom, left, note beam on child's leg. It keeps door open. Right, electric stairway with glass side to show mechanism

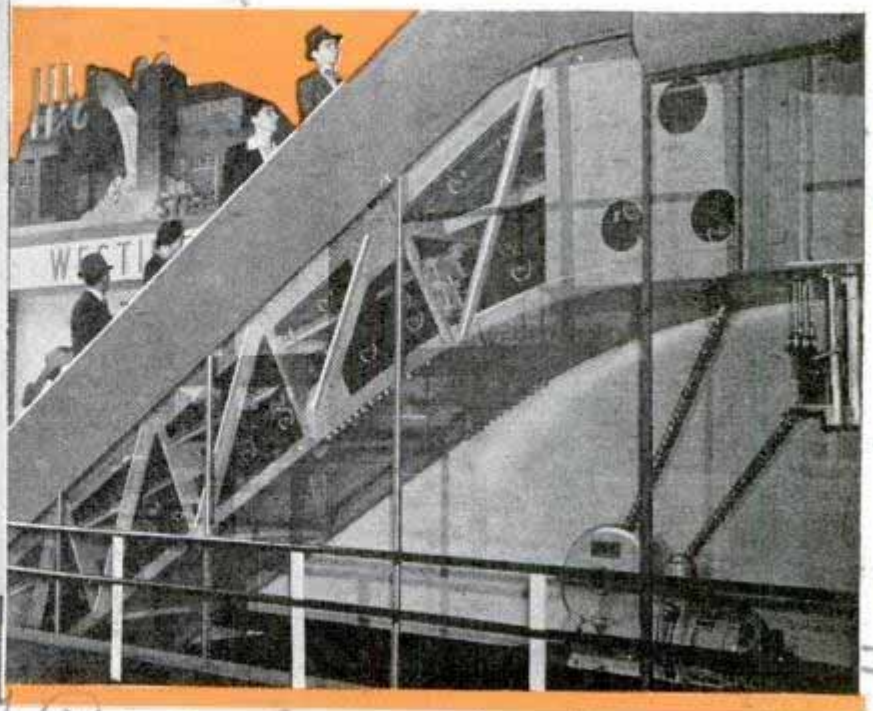




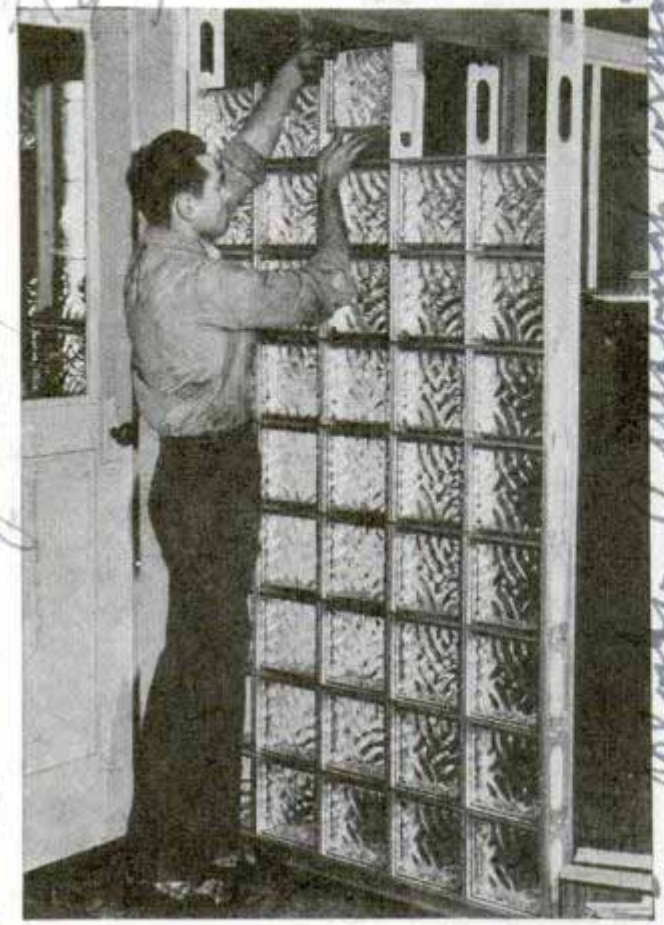
enter, the door closes automatically. At the touch of a button by the attendant, the car rises. Up in the machine room atop the shaft, a magnetic starter was turned on by touching that button, the brakes were released, the driving motor and motor generator switched on and a selector panel, with 200 shuntless, telephone-type relays, made ready.

As this modern elevator ascends, a carriage on the selector panel moves up a Lilliputian model of the actual elevator system, passing floors not signaled for,

(Continued to page 116A)



Glass Blocks Set in Frames without Using Mortar



Erecting a partition of glass blocks which are set into specially designed metal frames and locked

Glass block walls for home and office interiors are being erected now by a simple method requiring no mortar. The blocks are set in a framework of extruded metal shapes which lock together instantly, but can be dismantled quickly and erected again at another location. The frames are made of bronze or aluminum.

Nine-Wheel Trailer Rolls Earth Compacting Road Shoulder

Instead of rolling earthen highway shoulders with the usual cast-iron roller, a contractor has found a heavily ballasted nine-wheel trailer more effective in compacting the earth. At the front are four sixteen-by-seven inch tires, at the rear five. As the trailer, with its 17,000-pound load, is towed along a strip of shoulder, the front tires compress four furrows and the rear ones ride the ridges between them. Any low spots that show up are then filled and a final rolling given before laying a top covering. With rubber tires instead of the iron roller there is little adherence of earth, even in wet weather.

Nine tires under heavy ballast pack the earth smooth

Hiker's Packsack on Steel Frame Holds Week's Travel Supply

Hikers who desire to travel light can carry a week's supply of food and clothing, together with a bed roll, in a compact packsack mounted on a frame of steel tubing, and made of moistureproof green duck

Packsack at left is turned to show steel frame and back support, while another is worn on man's back

material. The cross bars are curved to conform with the wearer's back, and two tight cord webs across the frame make a comfortable support. Balance of the pack is obtained by placing the bed roll in the middle, which is flanked on the sides by two roomy compartments, one of which is divided into two sections to facilitate packing and unpacking.

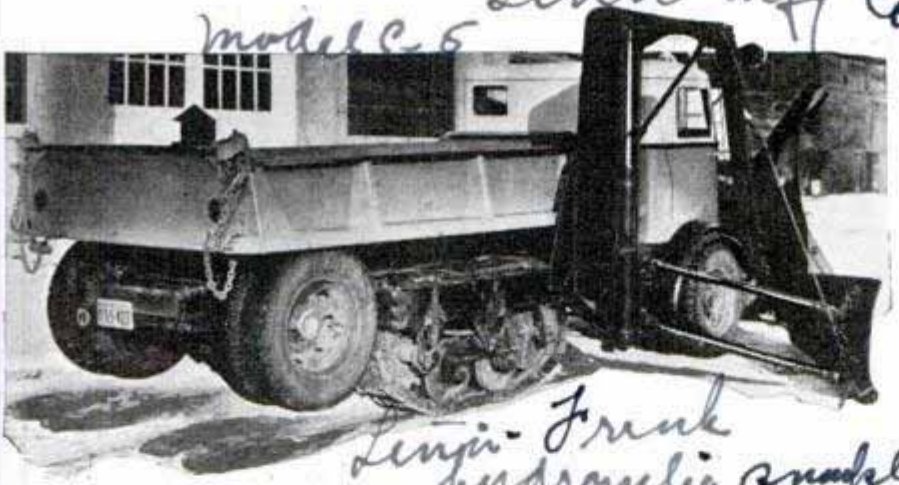
Spiked Wheel Pushes Iceboat at Thrilling Clip

High speed is claimed for an iceboat powered with a twin-cylinder motorcycle engine and propelled by a spiked wheel at the rear. Supporting the cockpit is a frame extending forward from the wheel, and the power plant rests on heavy runners at the rear. Protruding a half inch from the outer surface of the tire casing, forty-four quarter-inch carriage bolts spaced at regular intervals provide traction to push the 550-pound sled. The inner tube is protected from the bolt heads by a felt inner lining. All the controls are placed in the cockpit similar to those in an automobile. Steering is accomplished with a front runner having two knife-edge strips of steel which cut into the ice. A steel bar with a row of spikes fastened to it grips the ice and stops the boat when the brake pedal is pressed.

Motorcycle engine and spiked rear wheel give the builders of this iceboat a fast, thrilling ride. Streamline cockpit in front cuts wind

Truck Rides on Tractor Tread by Lifting Rear Wheels

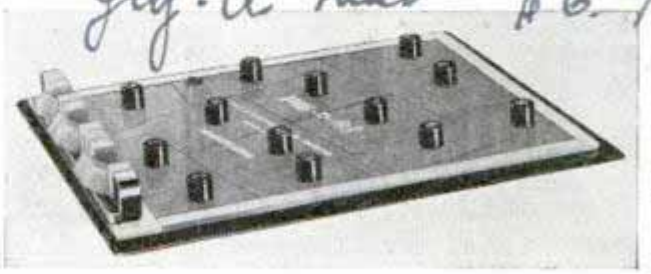
Riding on rubber-tired wheels or an endless tractor tread, as needed, a heavy-duty truck is capable of operating on smooth highways, on rough, open fields, in marshlands or deep snow. When the driver wishes to use the tractor tread, he draws the rear wheels up close under the body of the truck. Power can be shifted from one drive to the other as each is brought into use.



Working as a snow plow, truck uses tractor-tread to obtain traction on ice and snow covered street. Rear wheels are lifted away from pavement

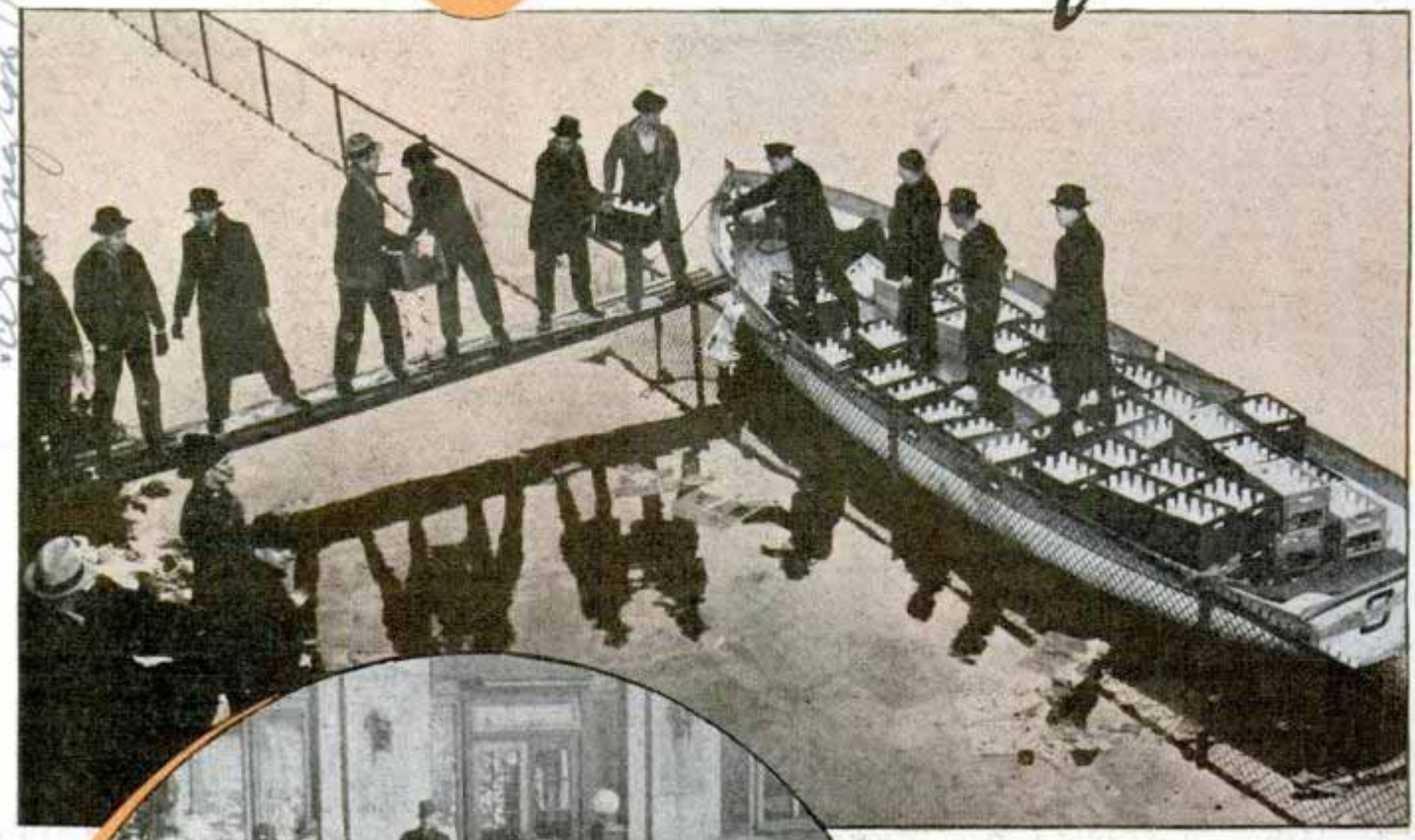
"Jig" Board for Making Photomontages Keeps a Record of Exposures

Preparation of photomontage layouts is simplified by the use of a "jigsaw" mat brought out recently. Its top consists of thirteen differently shaped Bakelite mats which can be arranged in various combinations. Each mat is numbered, and as it is lifted to make an exposure an indicator lever with the corresponding number is pressed to keep track of the section exposed.



Each sectional mat has number corresponding with indicator tab at left which shows exposed portion

HEROES of the



Milk arrives by boat, above, for flood refugees. At left, a boatload of homeless seeks dry land; the Red Cross rescued and fed 1,500,000 persons in the Ohio-Mississippi floods of 1937

TROLLEY wires over Cincinnati's streets were a distinct menace. They blocked urgent traffic in the darkness, threatened decapitation, even to boatmen who sat low. They had to come down. Chief Boatswain's Mate William F. Burton, in charge of the motor surfboat from Ocean City, N. J., squatted on the gunwales with Surfman Sam Mitchell and went to work with wire cutters.

They didn't work long—not at that job. Screams came from the river, hoarse with the terror of three men facing death in the dark, swirling waters of the Ohio. The coast guardsmen found them with flashlights, picked two of them off the keel of a capsized rowboat. But the swollen torrent prevented reaching the third man, who clung precariously to the ice-clad pier of a bridge.

Sam Mitchell didn't hesitate. Securing a line about his waist, he caught a bridge girder closer to shore where the current was not so swift, crawled hand over hand to the pier, tied his line about the nearly exhausted man. Burton hauled him safely into the surfboat as, without a hand on the

DELUGE

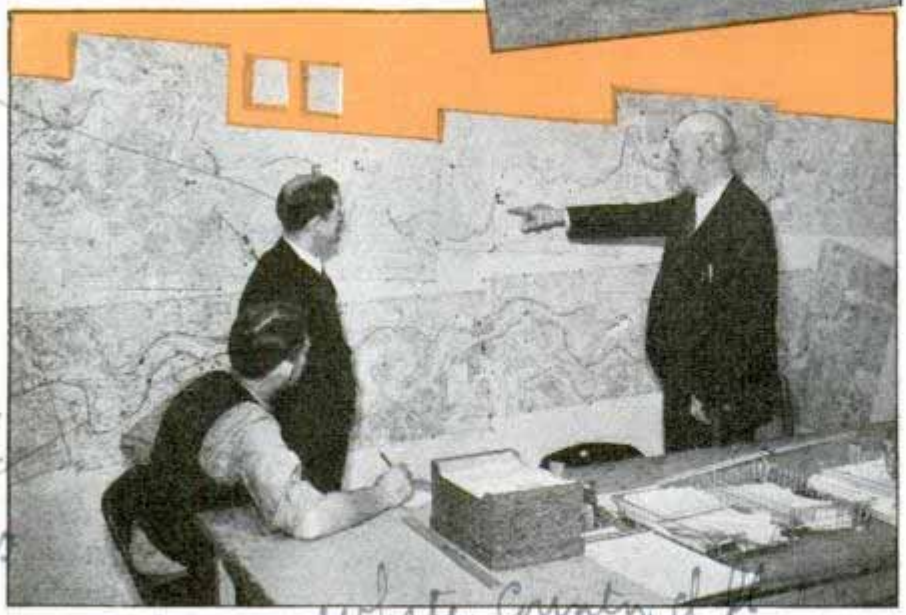
helm, it swept broadside down the torrent. Sam Mitchell was left in the rescued man's precarious place, without a line, with no one to help him in. With numbed hands he crawled to the starting point, hung there until his chief could recover control of the boat and return for him.

Such tales of heroic rescue are routine to the coast guard, whose stock in trade is saving life. But why is the coast guard performing tasks 600 miles inland? Why should a surfboat from New Jersey be cruising Cincinnati's streets on a winter night?

It's the deluge, the annual

Flood besieges Huntington, W. Va., top; circle, portable communication set; below, measuring river depth and velocity

American disaster. This was Ohio in 1937. It might have been California in '39, New England in '36, the Mississippi Valley in '27. It may be your city this year or next. Sooner or later the skies will open, provide too much water for the drainage system, flood the lowlands. And where you have floods you find heroes. It was no accident that an Ocean City surf-



Flood victims await rescue on roof of Illinois home, top. Center, rescue boat tours high waters around Memphis. Below, chiefs of Red Cross rescue division plot position of boats with pins on map of Mississippi river

boat turned up in Cincinnati when needed. Such things are planned.

Unlike tornado, fire, and earthquake, floods never strike without warning. That inferno of water that sweeps through great cities, swallows whole towns to disgorge them as heaps of twisted, filthy wreckage, was once merely raindrops that an umbrella could turn aside. Those raindrops, fall where they will, are constantly watched by the Weather Bureau. Through years of measuring river heights, army engineers have established just how much rainfall a drainage system can carry off without streams leaving their channels. When rainfall approaches the danger point, the Red Cross is notified.

The Red Cross has a formula for the defense of man against nature, proved effective in hundreds of disasters. Preparedness plans covering rescue, transportation, food, shelter, clothing and

medical care are worked out in advance as a general staff prepares war plans for an army. At the first warning, national headquarters arranges constant communication with Red Cross chapters in the danger area. As soon as the situation warrants, trained disaster relief personnel are sent. Veteran heroes of many floods, these workers estimate the rise of rivers, study contour maps to determine what areas a given crest will inundate. Then they make a rapid survey to determine how many persons will be affected; how many will have to be fed at emergency kitchens, how many sheltered at refugee camps, how much clothing and medicines are required, how much money for rehabilitation. They also arrange for police, boy scouts, and others, to warn those in danger areas to get to higher ground, with live stock and valuables. And so well is human nature charted, that they know about how many incurable optimists will refuse to leave until too late.

In the Ohio-Mississippi valley deluge of 1937, the homes of a million and a half persons were inundated in twelve states. The great majority of these persons went to high ground before the waters struck. But 63,778 were trapped because they were unwilling or unable to leave. All but 244 were rescued.

The Red Cross does not wait until such persons are actually marooned before making plans to get them out. Local chapters have lists of boats and skilled boatmen available, and when these are not sufficient, the coast guard is called. Lifeboats, surfboats, all types of rescue craft with skilled crews, are rushed on flatcar or truck to the threatened areas.

Which is how it happened that Burton and Mitchell were cruising Cincinnati, hundreds of miles from their home station, at the precise moment they were needed. This particular boat worked constantly in the flooded area, transporting food, serums, medicines, refugees. Four days and nights these two heroes toiled without sleep, through snow and rain.

Altogether there were 351 coast guard boats, manned by 1,800 sailors, at work in these inland waters during America's greatest deluge. They rescued more than 50,000 persons, 839 of them in immediate peril. They transported 6,000 Red Cross officials, nurses, laborers, and other relief

(Continued to page 124A)

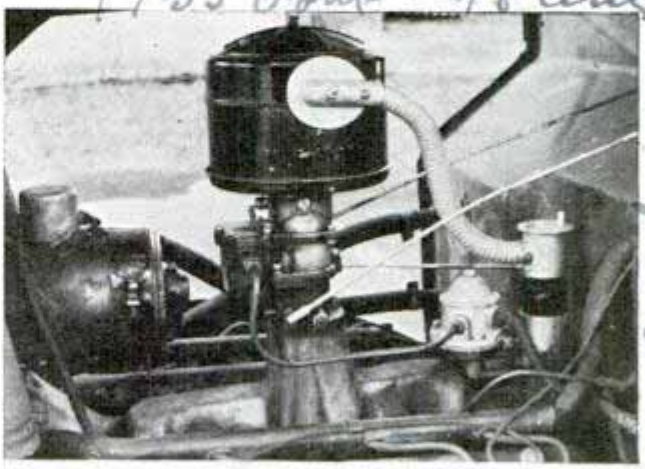
Speakers at Seats in Plane Entertain Travelers

Radio speaker in form of pad, resting on back of seat, permits individual passenger to hear program

Air lines are inaugurating a service which will enable travelers to enjoy radio entertainment. Connected to a receiver operated by the hostess, individual speakers are placed at all the seats. By adjusting the padlike speaker against his ear, one passenger may listen to the program without causing disturbance to others near by.

Carburetor Absorbs Gas Fumes to Keep Them Out of Car

Automobile engines that throw gas fumes into the car can be corrected by a crankcase ventilator that dispels the fumes at the carburetor inlet. This causes the gases to be drawn through the carburetor instead of remaining free to annoy the driver and passengers.



Fumes from crankcase are released at carburetor inlet instead of being freed where they may enter car

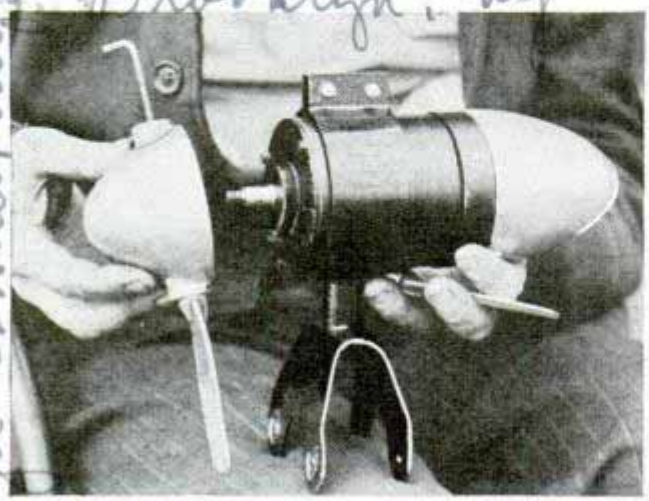
Car Lifted by Same Vacuum Used in Shifting Gears

Cylinder used for shifting gears, connected by tube to engine, is shown jacking up car by vacuum power

To demonstrate the ability of vacuum power to shift gears, one manufacturer rigged up a standard jack which used only vacuum from the engine for raising the car. The regular vacuum cylinder for the gear shift was removed from the auto and attached to the jack, which was equipped with a special lifting device.

Streamline Generator for Plane Stops Source of Vibration

Eliminating a source of vibration encountered in many light airplanes, it is claimed that a streamline generator will not throw or lose its propeller blades. This is achieved by using headless setscrews for locking the hub and blades to the generator shaft. The blades may be adjusted to any pitch for increasing or decreasing the propeller speed. Only a special screwdriver to fit the setscrew is needed in dismantling or assembling the instrument.



Note setscrew tool projecting upward from hub at left

Larger License Plates for Cars Cost Million More to Push

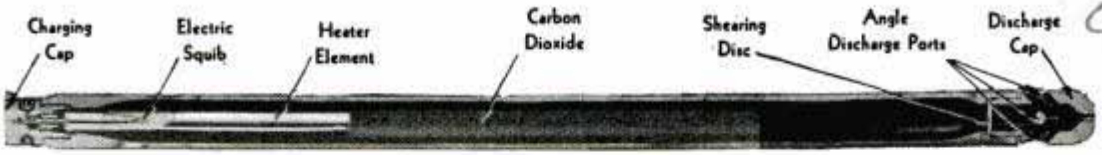
It will cost car owners in Michigan approximately $1,000,000 extra this year just to push around the 1940 plates, which are thirty per cent larger than last year's plates. The increased size, explains Prof. Felix W. Pawlowski of the University of Michigan, will add slightly to air resistance. The average motorist who traveled 12,000 miles last year paid $2.50 in gasoline costs to push along the smaller front plate, Prof. Pawlowski estimates. On that basis, additional fuel required for the new plates will cost an extra fifty cents.

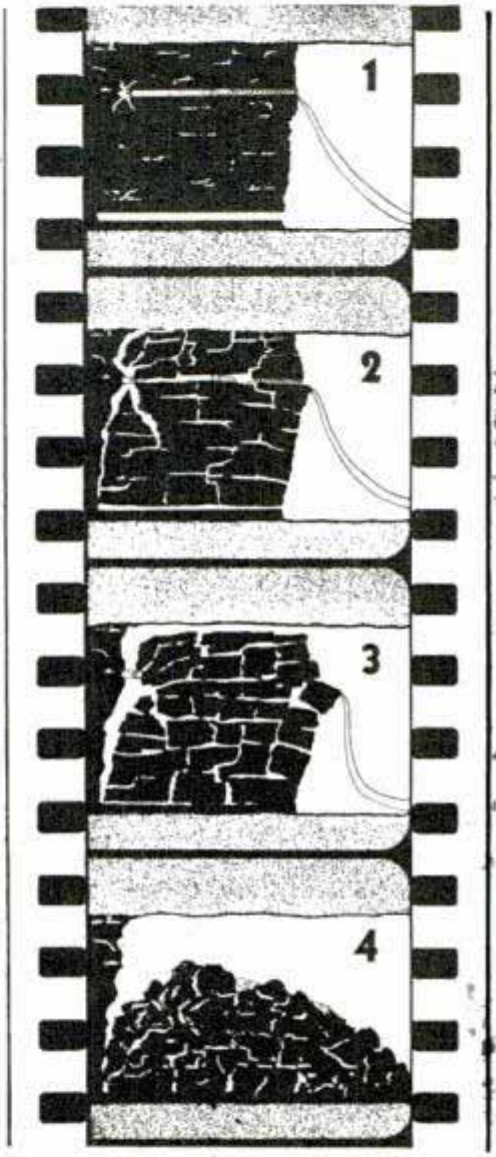
"Torpedo" Forces Brake Fluid into Hydraulic System

Hydraulic brake systems are serviced quickly by portable pressure tank that resembles a torpedo

With a torpedo-shaped pressure tank, one service-station attendant can bleed and refill the hydraulic brake system on any car or truck in a short time. An automatic shut-off valve prevents discharge of air into the brake line should the fluid level become low. Mounted on casters, the unit is pulled about the floor by its hose, a guard rail protecting the fluid tank against damage and also providing a rack for the hose when not in use.

Expanding Gas Used to Mine Coal in Safety





Top, diagrammatic view of tube. Note discharge ports where high-pressure gas is released. Left, inserting tube into hole drilled in the working face. Right, strip of drawings showing how the expanding gas breaks coal away from the face, instead of blasting it. One advantage claimed for the system is that it produces larger-size coal

Intended to promote safety in coal mining, a non-explosive method now in use employs expanding carbon dioxide to break down coal at the working face. It operates without smoke, flame or noxious fumes. Carbon dioxide, which will not burn or support combustion, is the same gas that puts the sparkle into beverages. The mining method involves the use of a hollow tube of chrome-molybdenum steel capable of withstanding internal pressures up to 40,000 pounds per square inch. Into one end of the tube is threaded a charging cap; into the other a discharge cap. After a heater has been inserted, liquid carbon dioxide is pumped through a valve into the charging cap. There are two electric terminals in this cap for connecting the shot-firing cables to an electric squib in the heater. The discharge cap is fitted with angle ports through which the expanding carbon dioxide is released at discharge. When current is applied to the terminals in the charging cap, the electric squib ignites the chemicals in the heater and sufficient heat is generated to instantly gasify the carbon dioxide, increasing the pressure. As the gases reach a predetermined pressure, a shearing disk gives way and the gas is released through the ports.

Electric Process Gives Metal a High Polish and Prevents Corrosion

By a process that is the opposite of electroplating, electricity can be used to give metal a high polish and at the same time protect it against tarnish and corrosion. Ordinary steel, copper, nickel, brass and zinc, given the electrolytic polishing treatment, attains a smooth reflecting surface superior to any produced by "elbow grease." The process involves electricity and a chemical solution that is strongly oxidizing in order to eat away the tiny high spots on the surface of the metal.

MECHANIZING

Low-slung truck, top, handles bales as they are bound, saving an extra pick-up. Center, one of the new light, three-wheeled tractors operating one-row corn binder. Two-row checkrow corn planter at bottom can cover twenty to thirty acres a day

BENEATH the placid exterior of the rural scene, a revolution is taking place. Science, greatest hired man of them all, has gone to work on thousands of farms, large and small, instituting new practices in growing and harvesting crops to meet changing conditions.

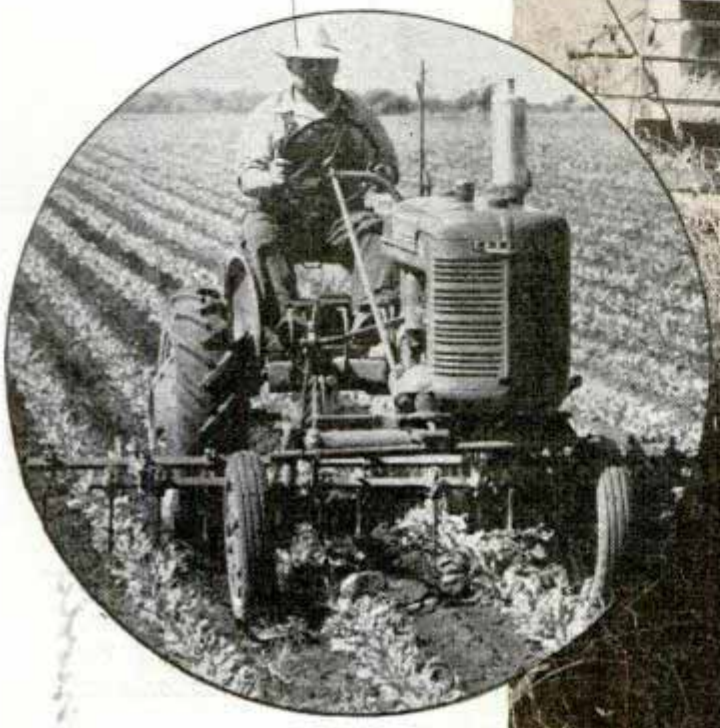
The farm is moving toward complete mechanization. Outstanding among the new scientific farming aids are compact, low-priced tractors that are ready to challenge the horse's claim to the richest prize of all, the small farm. Since motorization of agriculture began, millions of dollars worth of labor-saving devices have been developed, but until recently the bulk of them were aimed at the large-scale farmer.

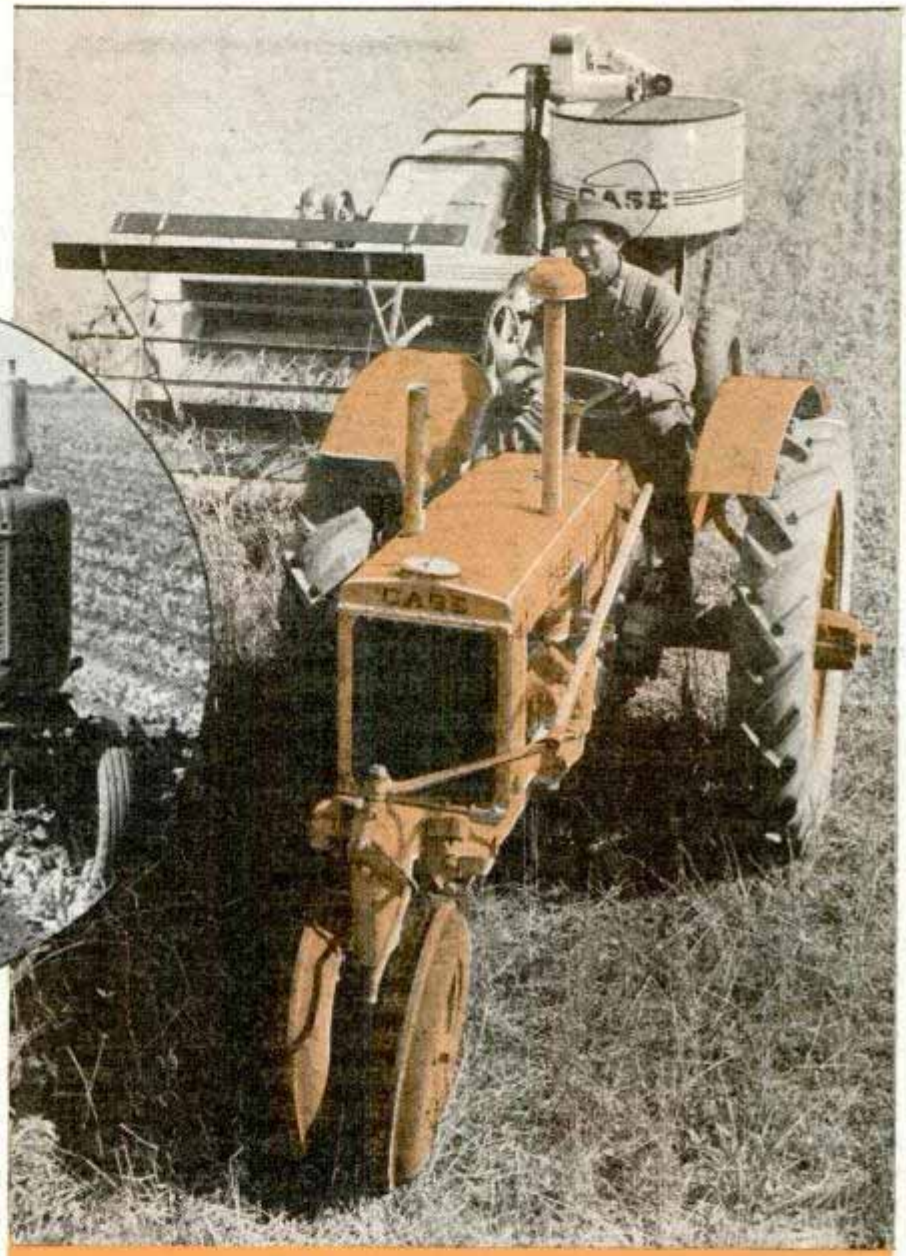
Government figures of April, 1939, showed only 1,625,820 tractors on the country's 6,800,000 farms. What of the other five million or so? Was it because of a sentimental attachment for the horse, custom, or simple agronomics they did not own tractors? In most instances, a matter of costs.

By and large, the machinery

the SMALL FARM

Combine, right, harvests and threshes in one operation. Offset engine of cultivator in sugar-beet field, left, lets farmer see to work tools close to plants; tool bars permit any setting of ground tools. Bottom, dusting California truck crop





has been too big, too expensive for the one-family farm. Even a cultivating type two-plow tractor couldn't be worked enough hours to make it pay. No farmer with, say, between twenty and ninety-nine acres—and he represents forty-two per cent of the total—could afford to spend $900 for a tractor, plus about $100 annual depreciation and a twenty-seven dollar carrying charge. If he used it thirty days, and that would be high, his costs exclusive of fuels and repairs would be $3.90 every time he took it out of the shed. Then, too, a tractor of this size is overpowered for many of the minor farm chores

Left, field pick-up baler cleans field and stacks crop speedily. Right, five-foot mower which attaches to tractor in a few minutes. Bottom, forty-inch harvester operated from power takeoff of small tractor

and high operating costs would limit its use.

The new type unit, which International, Allis Chalmers, and Ford are attempting to popularize, is designed for small-acreage operations and constitutes a real threat to the farm horse. With his present implements or special ones made for this model, a farmer can plow, harrow, plant, mow, cultivate, harvest, grind feed, fertilize, thresh grain, and haul crops with all the speed and efficiency of mechanical power, yet with low upkeep and operating expense. The single-row quick-hitch tools made especially for these machines are more economical than two-row equipment, but owing to their ability to work at the tractor's faster speeds, little is sacrificed in capacity. Tests indicate the cost of operating a small tractor is around thirty-four cents an hour, including everything—maintenance, depreciation, interest, taxes, and other items.

On a gallon of fuel an all-purpose tractor is said to be able to plow up to one acre, depending on soil conditions; disk two and one-quarter to three acres, plant three to four acres of corn, cultivate two or more acres of corn or cotton, cut two and one-half to three acres of hay, shell 200 to 300 bushels of corn, and haul a loaded wagon eleven to fourteen miles. Low operating cost and a reduced initial investment in machinery will bring the small farmer's production costs per acre in balance with those of the large-scale operator.

Farm experts estimate a horse costs eighty dollars a year to maintain; in terms of land, approximately five acres are required to produce his feed for a year. If the small tractor were to supplant four horses, that would mean the release of twenty acres for planting a cash crop or making it available for paying livestock or poultry instead of being used exclusively in raising "fuel" for muscle power.

The evolution of the tractor, Eugene C. McKibben of Iowa State college explains, parallels the physical change in the farm itself. Mechanization started with the big

steam-power outfits on the wheat kingdoms of the Great Plains. Crop diversification followed and when the land was split into farms with fences, the Juggernauts were found too unwieldy and machines with internal combustion plants replaced them. Fields continued to shrink, three-plow tractors gave way to two-plow tractors, until now the latter are making room for fast, compact models built for the intensive, diversified cultivation that's practiced on over sixty per cent of the farms.

Combines have traveled a similar course. More than a century ago the first machine which cut and threshed grain in one operation made its appearance. The big steam combines didn't make much headway until after the turn of the

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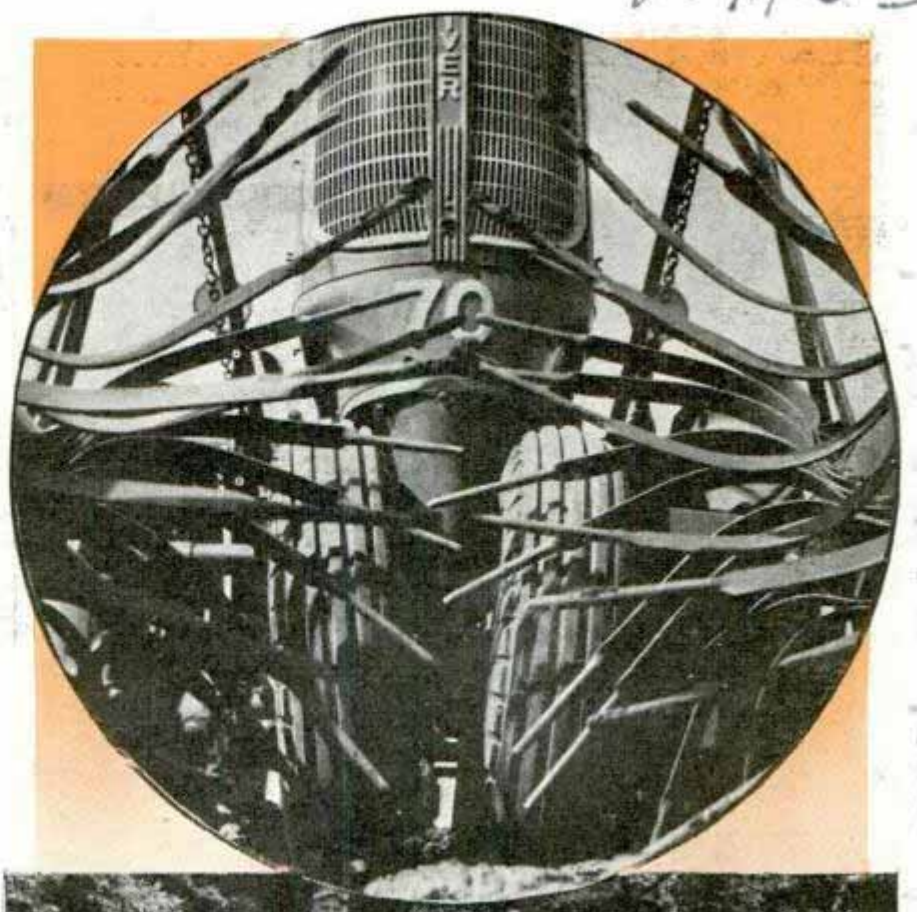
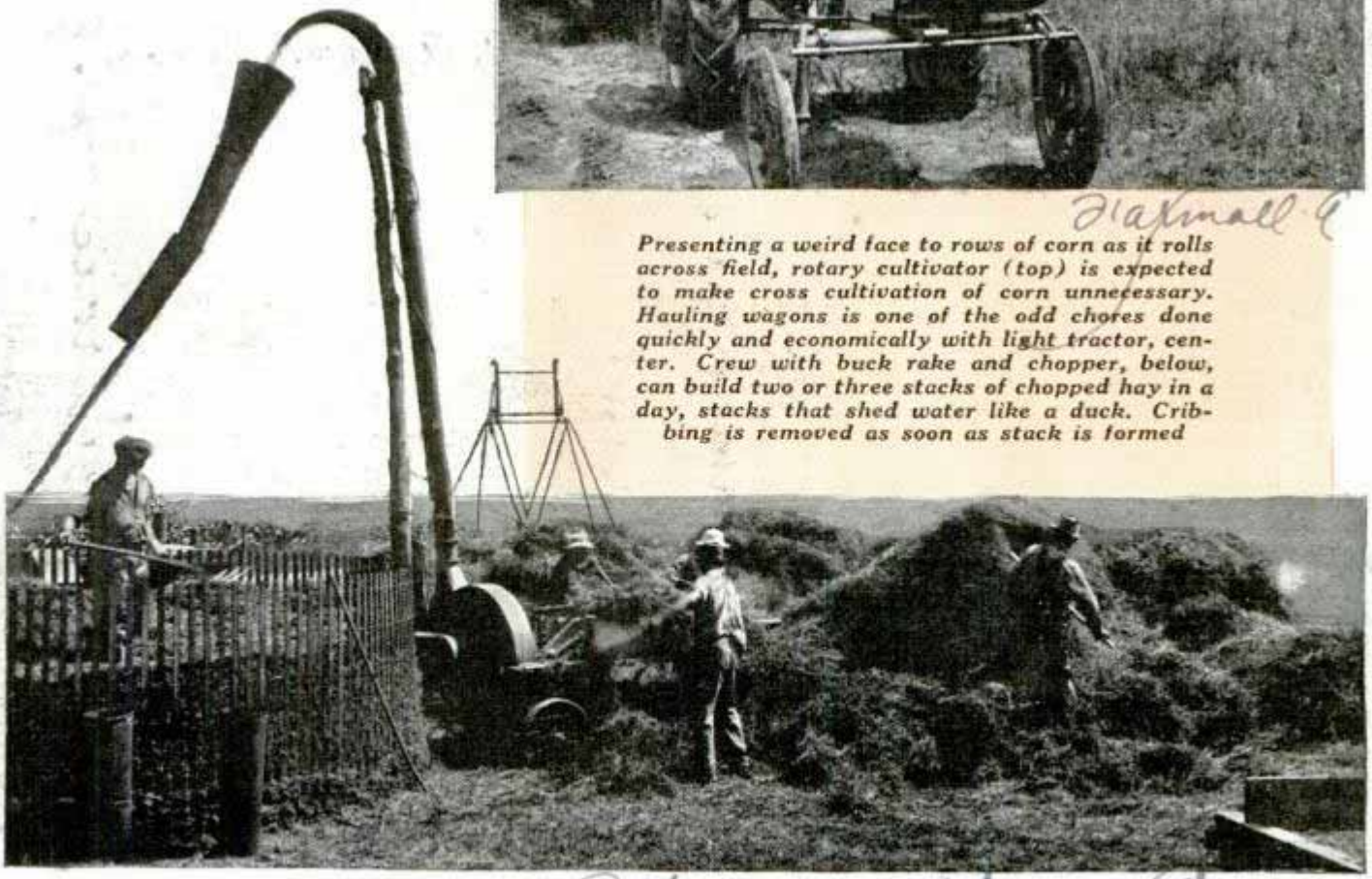
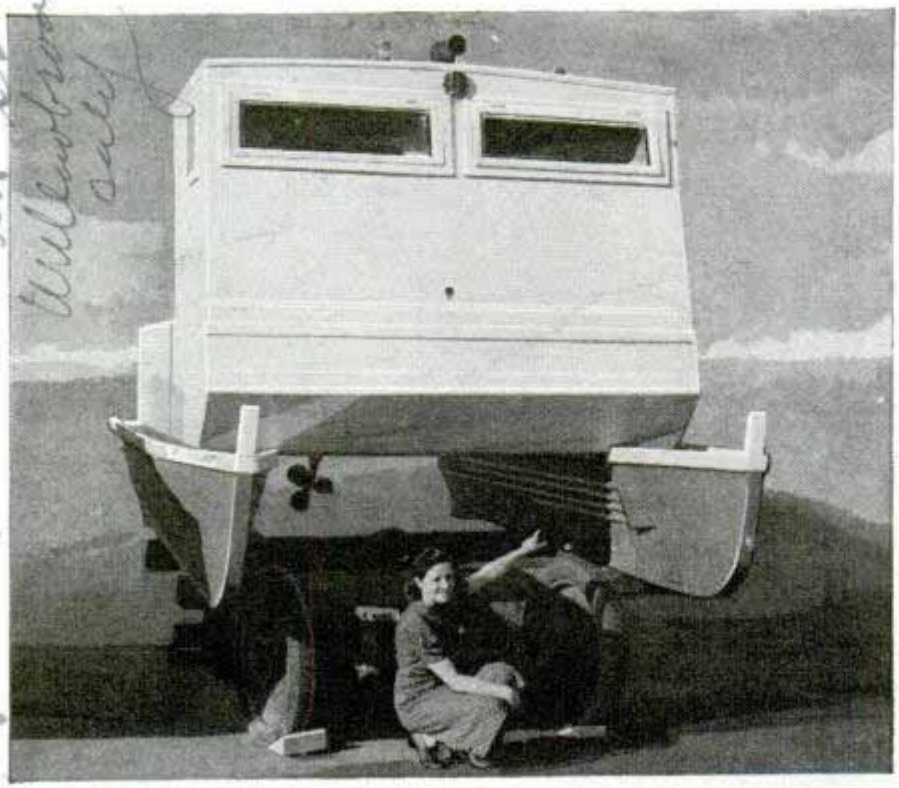




Presenting a weird face to rows of corn as it rolls across field, rotary cultivator (top) is expected to make cross cultivation of corn unnecessary. Hauling wagons is one of the odd chores done quickly and economically with light tractor, center. Crew with buck rake and chopper, below, can build two or three stacks of chopped hay in a day, stacks that shed water like a duck. Cribbing is removed as soon as stack is formed

'Sea Sled' Built on Twin Hulls Has Engine Cooled by Water



Pointing to cooling-system pipework of "sea sled" mounted on wheels and ready to be hauled out to sea where it will be virtually swampproof

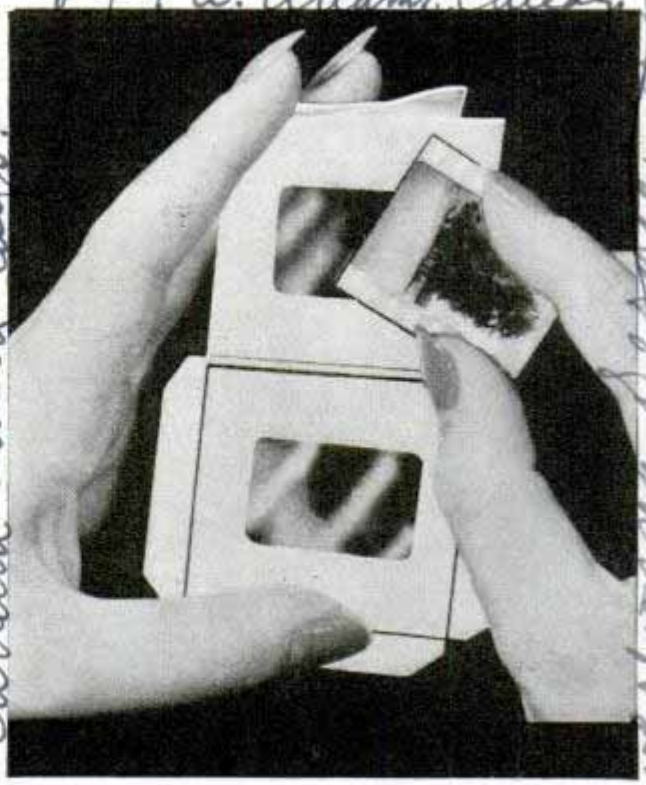
Departing from conventional design, a boat with a double set of hulls is said to be virtually swampproof in rough seas. A highspeed marine engine with a fresh-water cooling system drives the craft, which has been launched in the waters off southern California for fishing and pleasure cruising.

Stars Spun Back by Planetarium Reveal First Calendar Date

By turning back the stars in the Buhl planetarium through 5,200 years of sky history, Dr. Jotham Johnson, archaeologist at University of Pittsburgh, declares he has found proof of his theory that the Egyptians started their calendar June 18, 3251 B.C. Historians generally agree that it probably began when Sirius, the Dog Star, brightest star in the heavens, rose over the eastern horizon just before sunrise. Since the earlier calendar had been based on the moon, it would be more than likely that the change was made when a new moon month was beginning—and, finding that a thin new moon appeared that night in the west, just after sunset, Dr. Johnson offers this as additional evidence to support his theory. The Egyptian calendar lacked a Leap Year and so in 1,456 years it slipped back an entire year. This period is called the Sothic cycle. One such cycle ended in 139 A.D., and counting back from there some historians have speculated that the Egyptian calendar might have started in 2773 B.C. or 4229 B.C. Dr. Johnson, however, considered the former date too late in Egypt's civilization, and the latter too early.

One-Piece Frame Binds Slide in Alignment

Preparation of photographic film for projection has been simplified by the use of a one-piece slide binder. It consists of a metal-surfaced paper with a die-cut center opening. The two pieces of glass are mounted together on the paper. A gummed tab anchors the film in position, then the two "windows" are folded together and the flaps moistened and sealed.



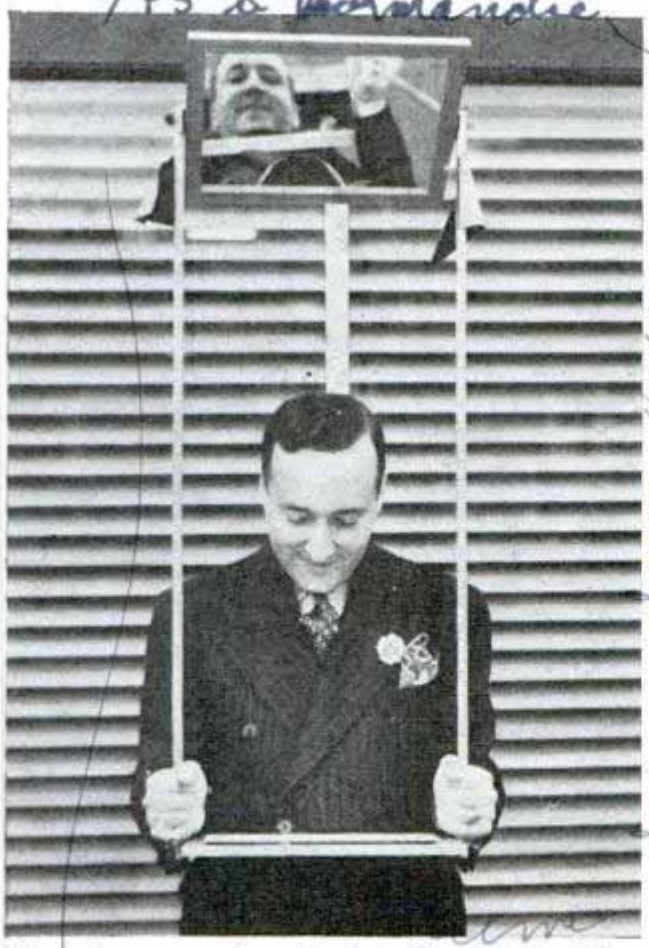
Gummed tabs hold the film transparency in position in this frame for two-by-two projection slides

Control Tower Speeds Traffic at Toll Bridge

Growth in the volume of motor-vehicle traffic across Golden Gate bridge has brought about the erection of a traffic-control tower on the plaza overlooking the toll booths. From there, oncoming cars and trucks may be directed to any of the fourteen lanes to avoid congestion during rush periods. A microphone connected to powerful loud speakers at each end of the toll plaza permits special announcements to be made from the tower, and a two-way communication system connects the tower with each toll collector's station, the fire department and the tow-car service department, permitting instant contact for emergency calls or routine reports. The officer on duty also may "tune in" any collector's booth without the patron and collector knowing he is listening.

"Traffic dispatcher" in bridge control tower talks through "mike" to any toll station or directs cars by issuing orders through loud speaker

Periscope for Watching Parade Made of Two Mirrors

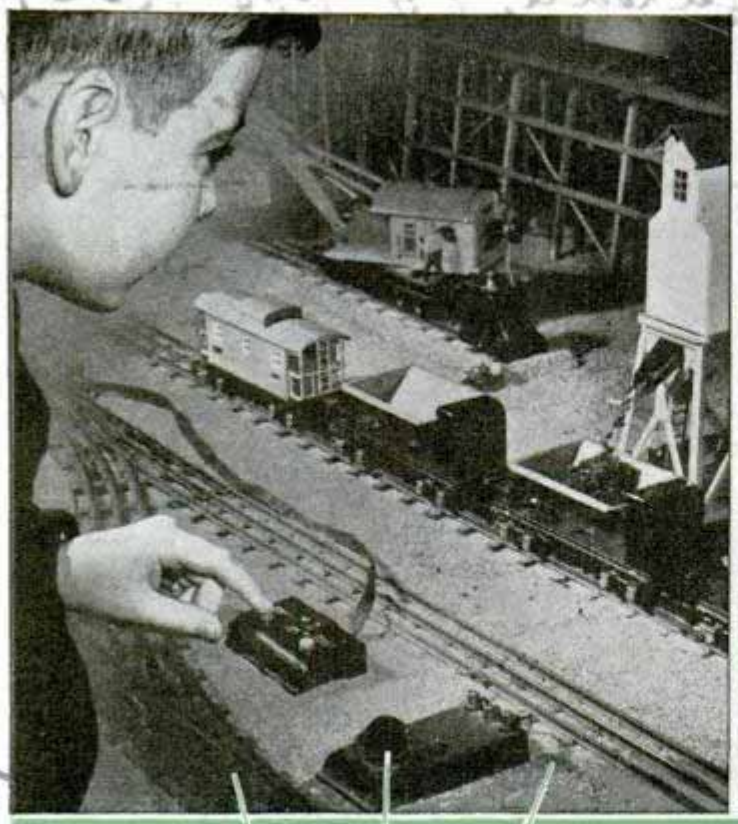


Two mirrors, two lengths of wood and four adjusting nuts form a periscope for parade watcher

Two rectangular mirrors and two wooden "connecting rods" formed a simple periscope homemade by a Los Angeles man for watching parades. The mirrors are held at the proper angle by adjusting nuts.

Animals' Eyes Don't Shine in Dark If No Light Strikes Them

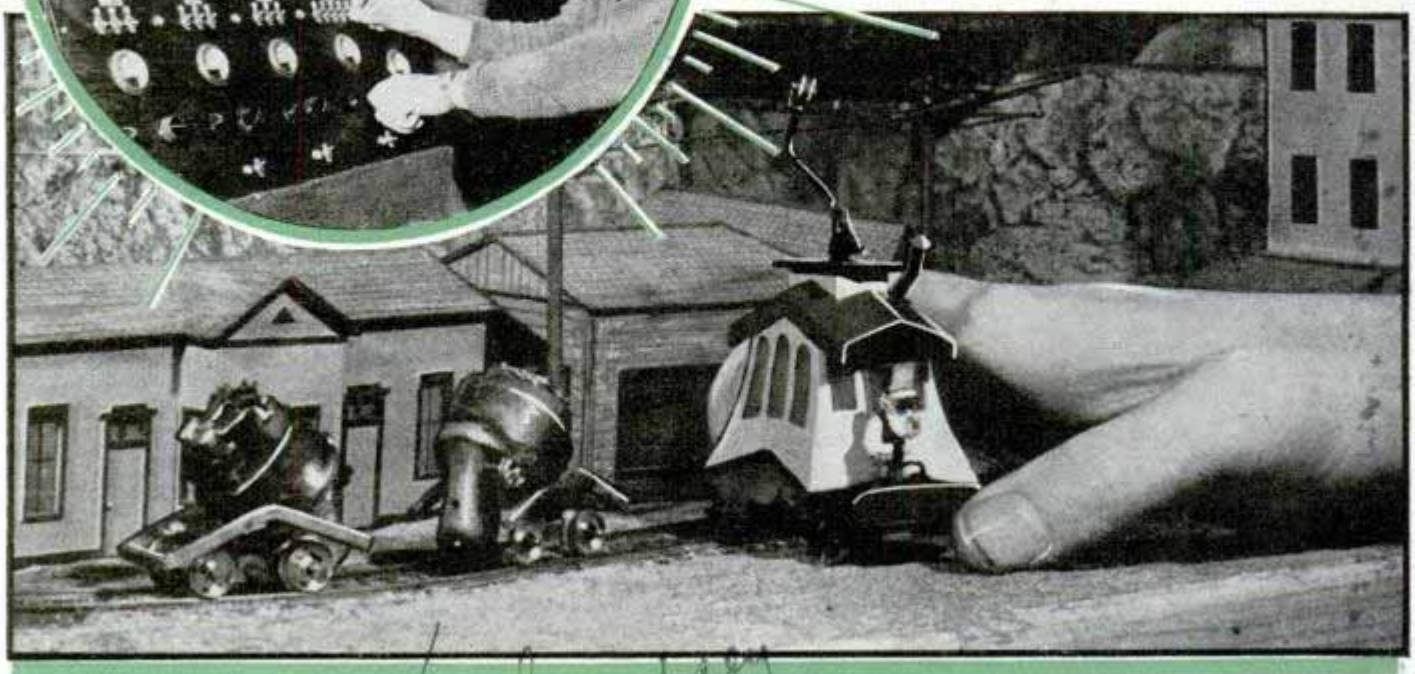
Animals' eyes do not shine visibly in total darkness, since they shine only by reflected light and must have at least a little light to produce the slightest gleam. Carrying a small flashlight lamp in a reflector on his forehead, Ernest P. Walker, assistant director, studied hundreds of specimens in the National Zoological Park at Washington, D. C., and obtained more reliable records than those gathered heretofore in the field. Eyes of different species, he found reflect light in widely differing ways. For instance, alligators and crocodiles give the impression of a brilliantly glowing pinkish opening in a dull-surfaced bed of coal, while some smaller rodents have eyes that shine like an illuminated piece of amber.



Top photos from Lionel Corp.

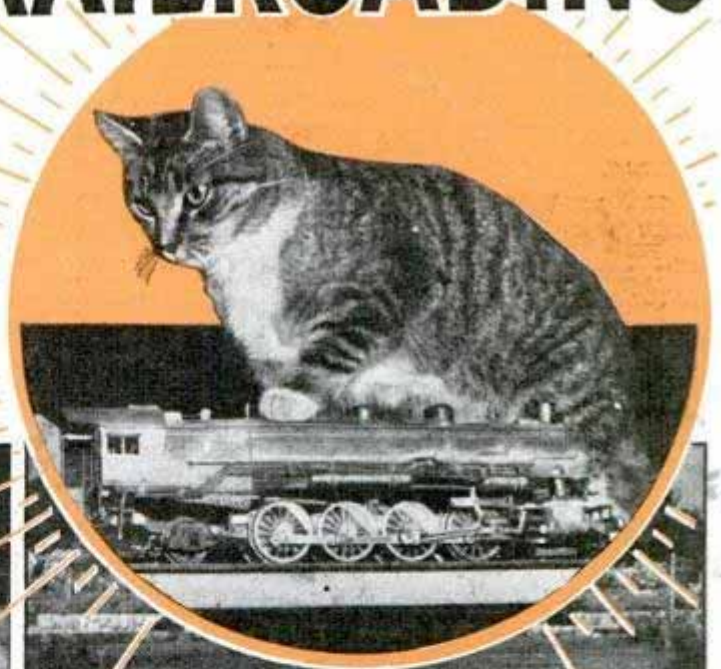
The LATEST in

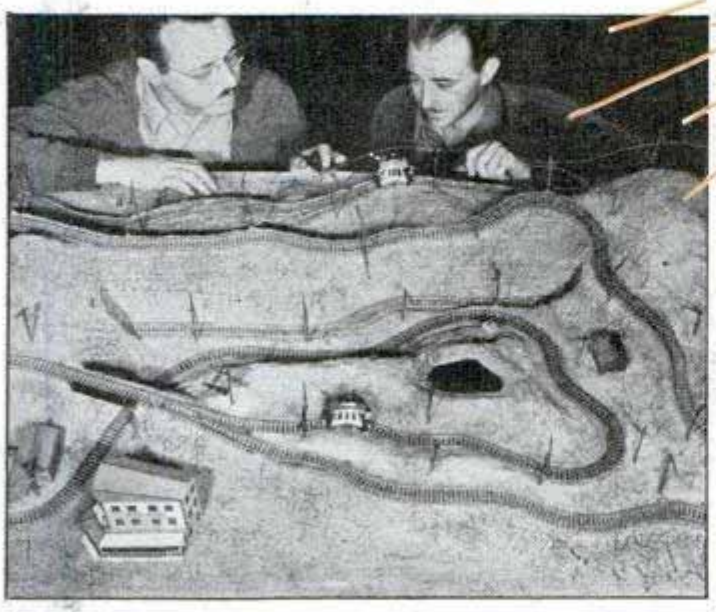
Model-railroad clubbers started something when they began operating miniature railways by remote control, with block systems, electric switches and train lights under dispatcher's control. Now even beginners at playroom railroading demand automatic operations. Above, one push button chutes coal from tower into hopper car, another tilts hopper to empty car. Left, switchboard controlling 400-foot sectionalized track of Los Angeles Model Railroad Club, with twenty electric switches; train positions are shown by indicator lights on panel. Below, "Toonerville trolley" and two of its hand-built motors

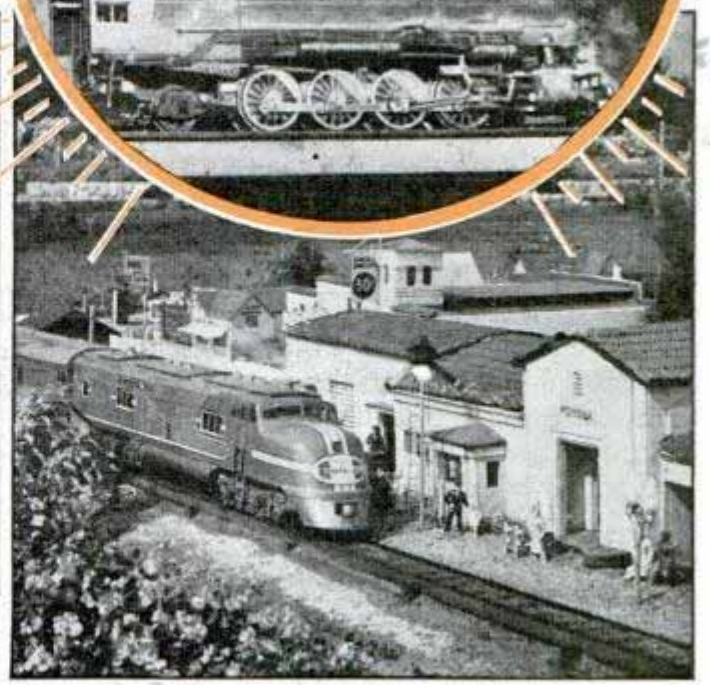


PINT-SIZE RAILROADING

Above, adjusting a drive wheel on tiny switch engine, which faces a heavy "Challenger" type passenger engine on a wooden trestle. The most avid model railroader insists on accurate copies of real locomotives such as the heavy-duty Union Pacific engine shown at right. At lower right the Santa Fe Diesel-electric streamliner draws up to model station in model town all constructed to scale of half inch to the foot. Below is the complicated layout of Toonerville trolley system with steep hills, sharp curves, tunnels, bridges, automatic switches and overhead trolley wire







Much fun for model railroaders comes in building equipment for systems like Toonerville line, above

Meter Is Read from Outside through Periscope in Wall

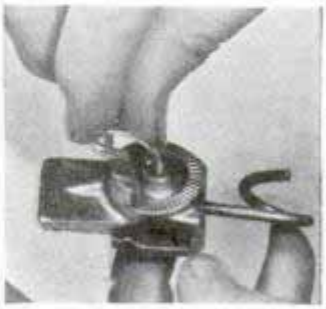
Gas meter dials can be seen through periscope in house wall so reader needs not enter the building

Meter readers are enabled to read the gas or electric meter without entering the home, by means of a periscope mounted permanently outside the house. The outer sleeve of the instrument is adjustable so readings can be taken in a standing position, and there is an opening at the bottom to permit use of a flashlight to illuminate the meter dials.

Coal Dust Speeds Melting of Ice by Absorbing Sun's Heat

You couldn't burn enough coal to melt ice and snow from the highways, but spread coal dust over the ice and it would aid in melting it. Prof. H. Landsberg of Pennsylvania State College found in an experiment that ice blocks covered with coal dust melted in four hours, while only fifteen per cent of the ice blocks uncovered by coal were melted in the same time. The explanation is simply that black coal dust absorbs solar heat while snow and ice reflect it. If this use of dust could be applied on a large scale, he pointed out, it might change climates and even help free Antarctica from its ice sheath. The supposedly vast coal deposits beneath the Antarctic ice could be spread each summer to hasten the melting of the polar cap. Glaciers which are now the breeding grounds of cold-air masses affecting climate and weather of civilized regions might some day be melted by widespread use of coal dust and thus soften the climate of the moderate latitudes.

Aluminum Jaws Bite into Canvas and Hold It in Firm Grip



Boatmen, farmers and motor-truck operators find it easy to anchor canvas in place with a gripper whose jaws hold tight to lapped or unlapped edges of any tough fabric. It can be adjusted to take up any slack that develops and will stand a heavy pull without injuring the material. The gripper is made of non-corrosive aluminum alloy.

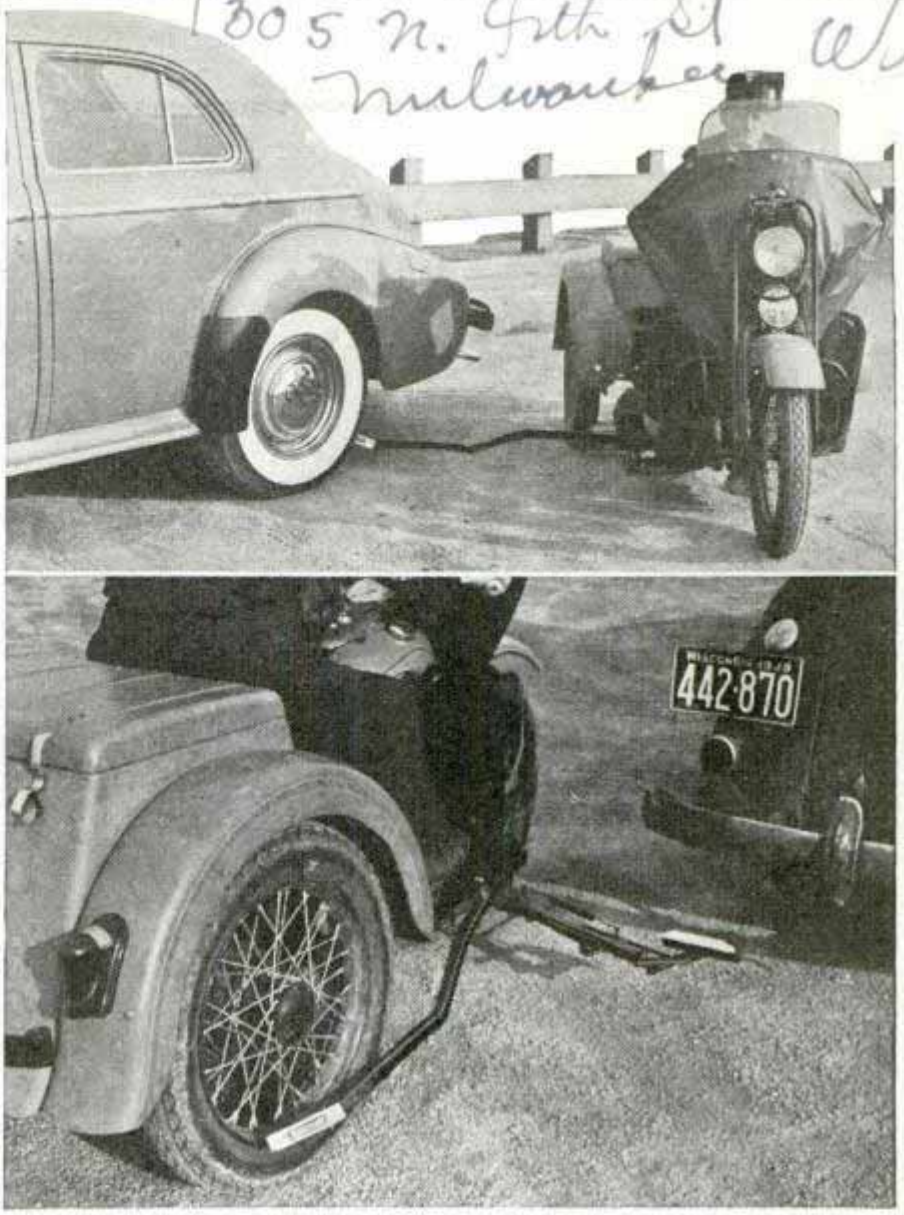
Jet of Flame Shoots from Lighter to Ignite Tobacco in Pipe

You can produce a vertical or a sidewise jet from a two-way lighter just offered for cigarette and pipe smokers. The standard wheel, flint and wick form the regular flame for a cigarette. Tip the lighter to one side and the flame contacts a tiny copper tube, and expansion of gases causes a slender flame to shoot into the bowl of the pipe.

When the lighter is tilted to one side, a flame jets sidewise directly into bowl of pipe

Extension Arm Marks Tires of Parked Cars

To help motorcycle policemen check the time cars are parked in restricted areas, extension arms for marking the tires of cars are available. One arm, twenty-two inches long, has a piece of chalk imbedded in the end. This arm reaches under the cars and makes a chalk mark across the tire tread. The mark wears off if the auto is moved, and serves as evidence of overtime parking if the car is not moved. A push button on the motorcycle handlebar sends the arm out by vacuum power, and it returns automatically when marking is completed. If the twenty-two inch arm is inadequate, there is a foot-operated one more than twice its length which can be used.



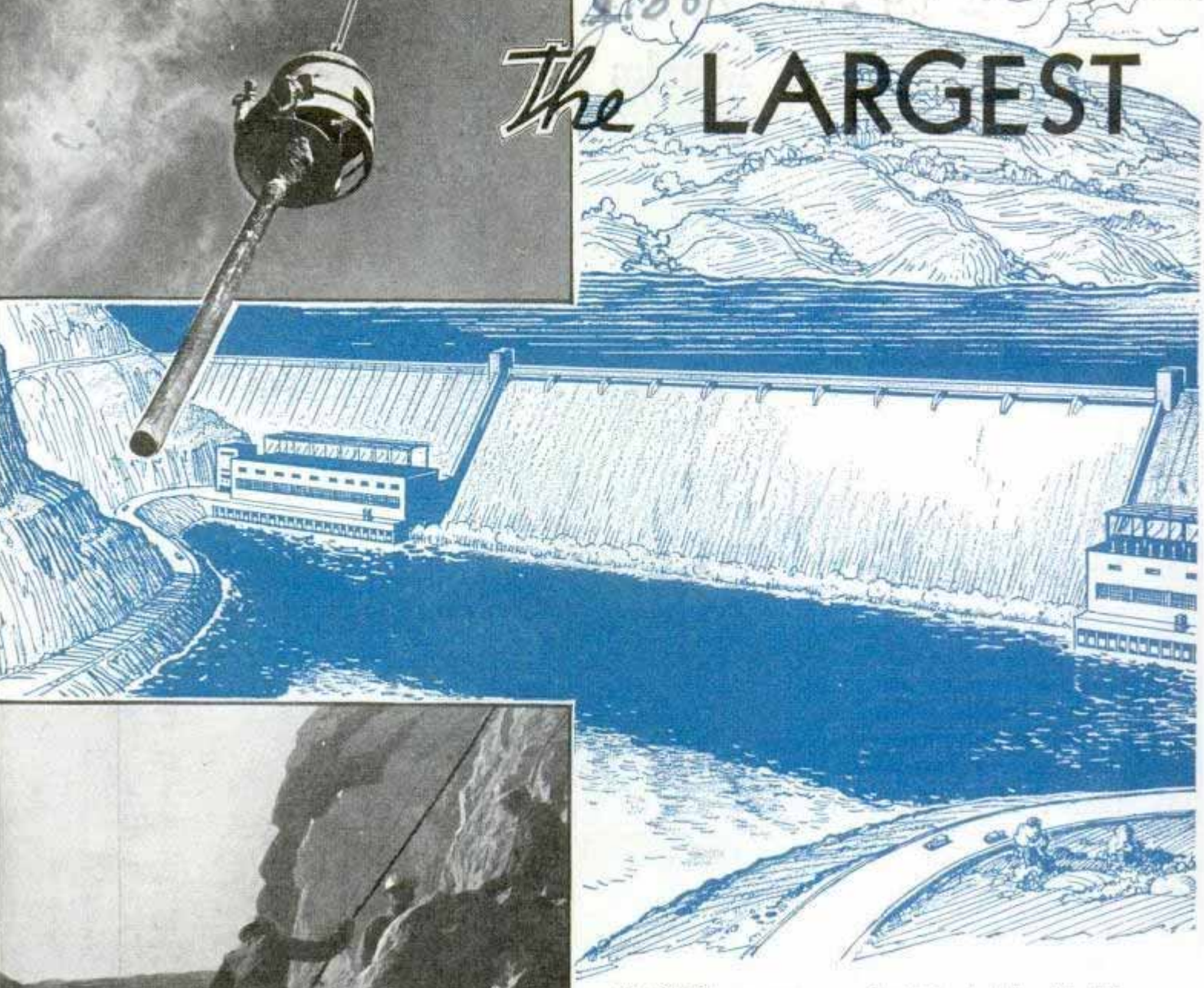
Right, top, long extension arm swings out to mark tire of car parked at forty-five degree angle, while the twenty-one inch arm, bottom, will reach auto parked parallel to curbing

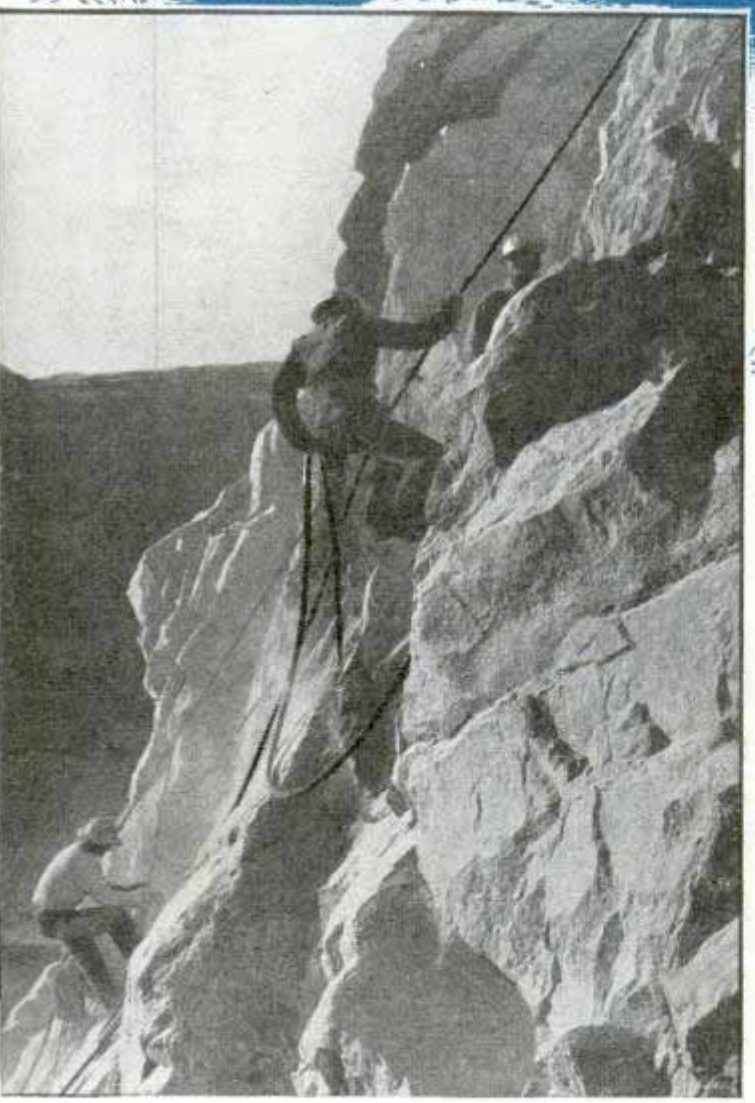
Speedy Saw Mounted on Tractor Cuts Logs and Cordwood

One man operating a circular saw that can be fitted to nearly any row-crop farm tractor, can cut trees into short lengths right in the woods where they fall. This saves the work of hauling the logs to a stationary power saw. The tractor supplies power through a take-off, and the operator swings the saw into cutting position from the driver's seat. It is safer than many saws since the driver ordinarily feeds the saw into the wood instead of feeding wood into the blade. For use in cutting the small branches a metal frame with two steel legs, reaching to the ground, supports a horizontal saw table about eighteen inches high. This folds back upon the tractor radiator. The sawing equipment can be detached in a few minutes.

Tractor-powered saw cuts tree logs where they fall

The LARGEST



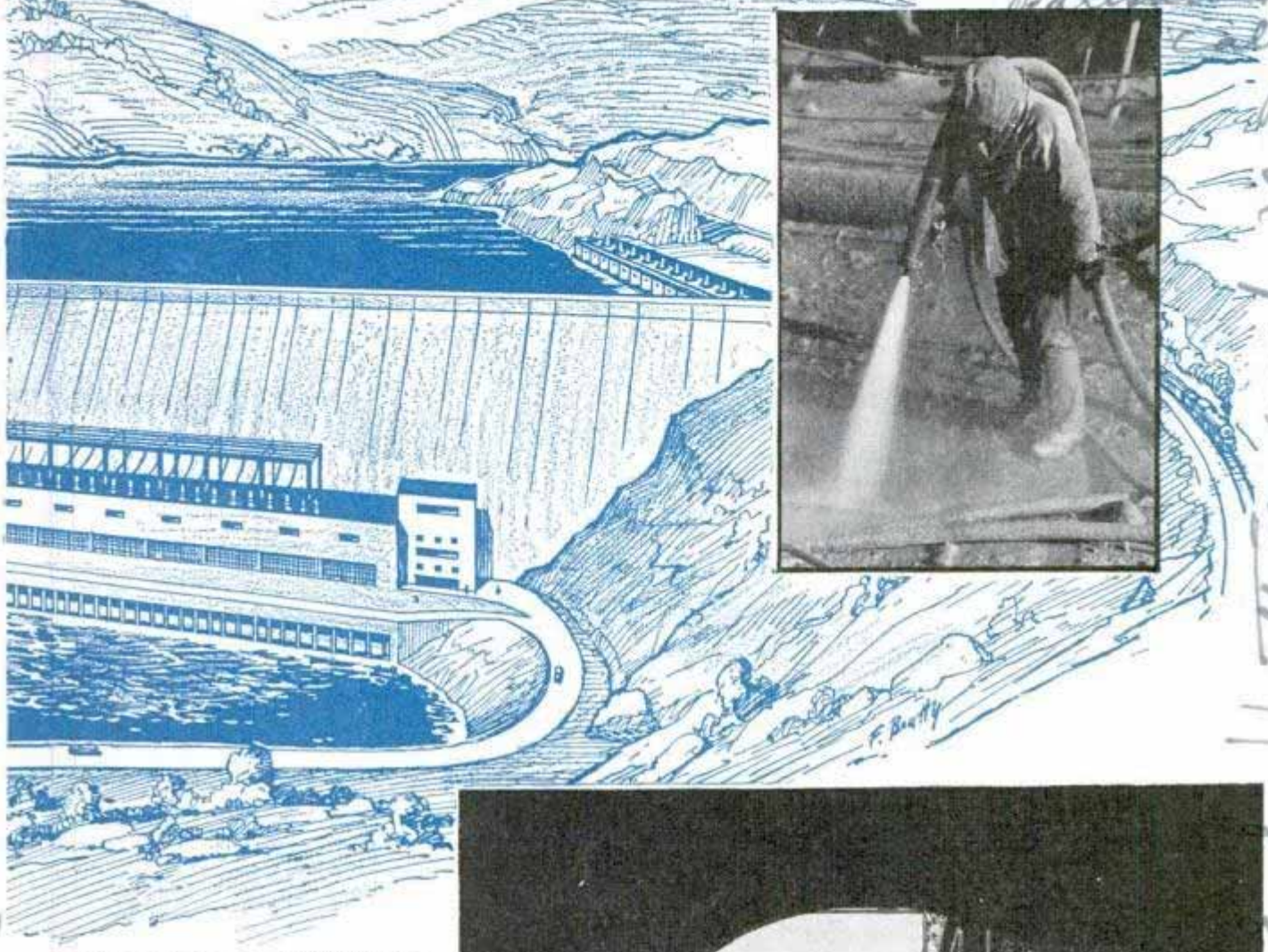


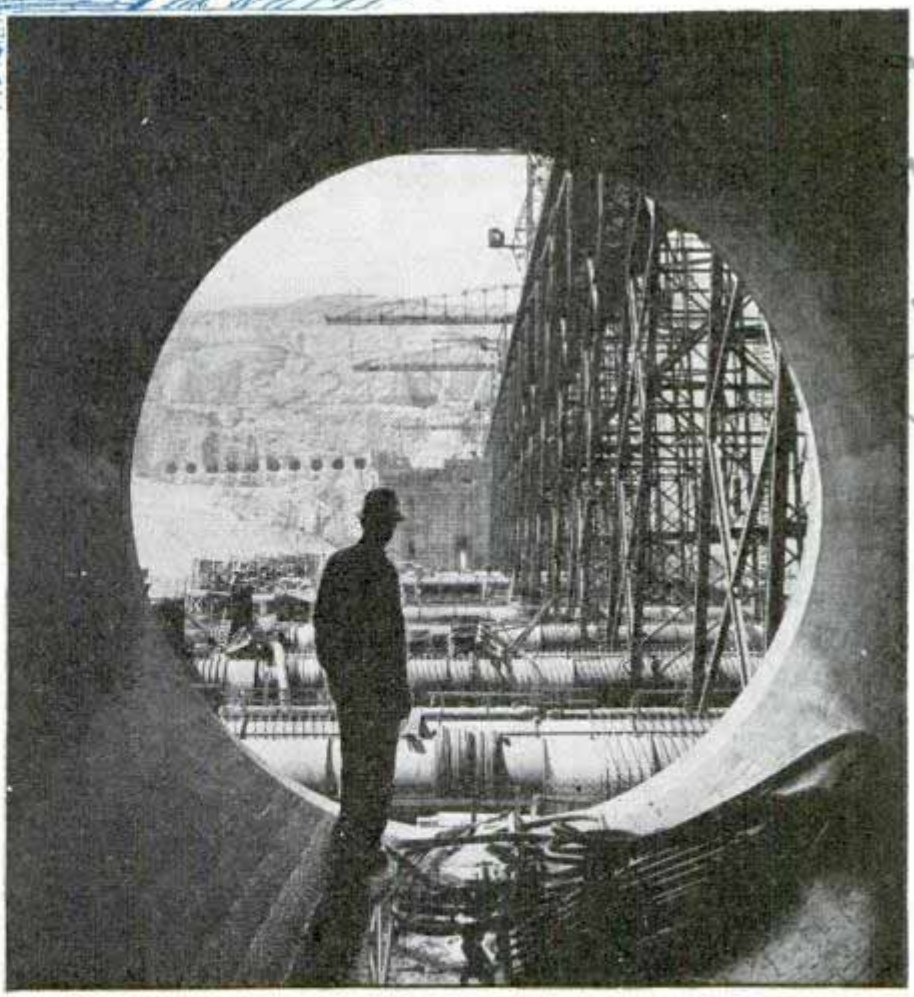
Top, hopper with tubular spout for pouring concrete into wall forms. Center, draftsman's conception of completed dam. Bottom, jackhammer operators working on steep abutment walls

LONG ago man acquired the habit of building great monuments that would stand for centuries. The latest and greatest of these monuments, the Grand Coulee dam in the state of Washington, is now so close to completion that engineers are busy preparing for its future. The man-made mountain must go to work.

The dam is to be the largest thing ever built, three times the bulk of Boulder dam and four times the volume of the Great Pyramid. It's almost a mile long, 550 feet high, and its thirty-acre base is 500 feet wide. It will hold back the mighty Columbia, the most powerful and the second largest river in the country. Into the dam is going nearly 12,000,000 cubic yards of concrete. The dam and its power plant will cost an estimated $186,000,000 with an additional $208,000,000 estimated as the cost of the irrigation system that is part of the project. In spite of this staggering price the engineers regard it as a bargain. It will provide water for cultivating 1,250,000 acres of rich but arid land now lying useless. That's

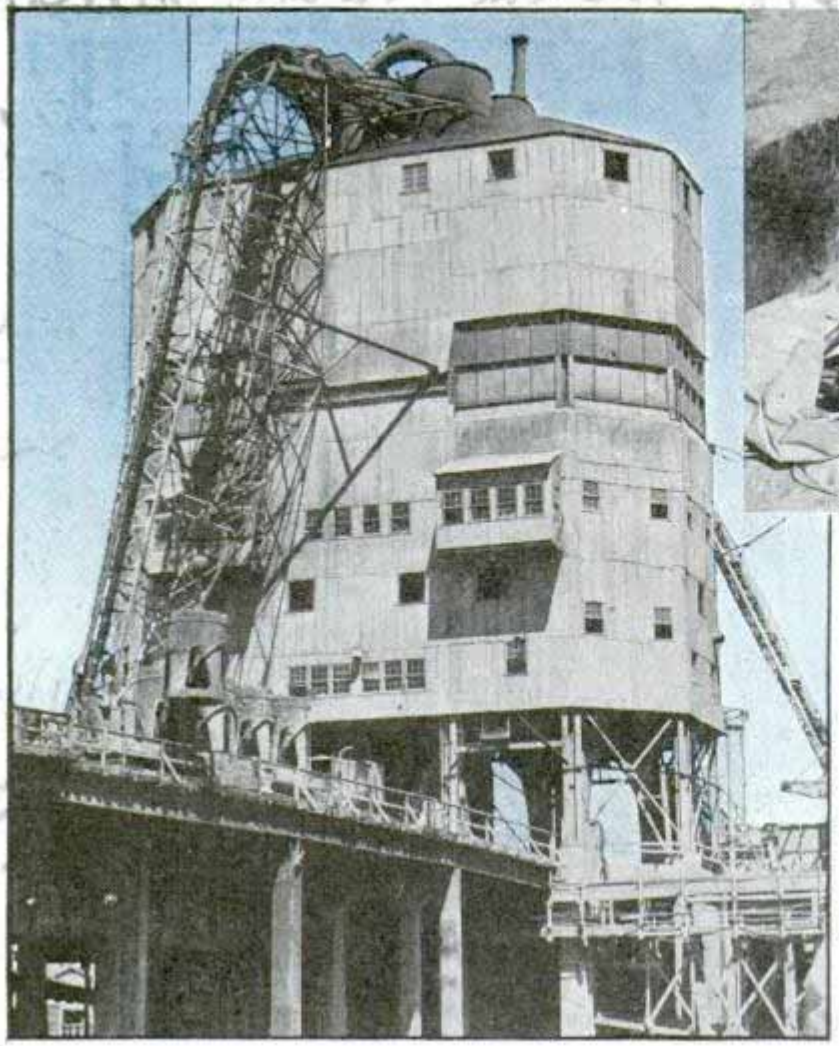
THING EVER BUILT





the same as adding an area about the size of Long Island to the most valuable agricultural assets of the nation. From twenty-five to fifty years will be needed to develop the region, opening a minimum of 25,000 acres per year to cultivation. This agricultural empire, extending as far as 150 miles from the dam, will provide comfortable livings for from 100,000 to 200,000 people. Mean annual temperature of the area is 50.4 degrees with an average frost-free period of 159 days. Forty acres of land per settler or eighty acres per couple may be purchased at terms governed by the Anti-Speculation Act.

Top (inset), scouring surface with sand-water-compressed-air blast before pouring cement results in stronger, watertight union. Bottom, looking out across spillway section from a twelve-foot control cable gallery



The dam is backing up a lake that will contain 10,000,000 acre-feet of water, reaching upstream to the Canadian border 150 miles away. The contents of this reservoir could supply all the needs of New York City for ten years. Railroads and highways, two small towns and several settlements are being moved above the future shore line.

About one-seventh of the average flow of the Columbia will be diverted to the irrigation project. This volume will be pumped to the canyon rim 280 feet above the reservoir and from there it will flow to a balancing reservoir twenty-seven miles long. This balancing reservoir is an elevated channel that the Columbia once cut when its present deep canyon was temporarily blocked by a glacier during the last ice age. From this upper reservoir the water will be distributed through canals to the parched land to the south. The high-water season on the upper Columbia river occurs in summer. It is coincident with the irrigating season, so surplus flood-water will not only irrigate the land but will supply the power required to pump it out of the deep-river canyon.

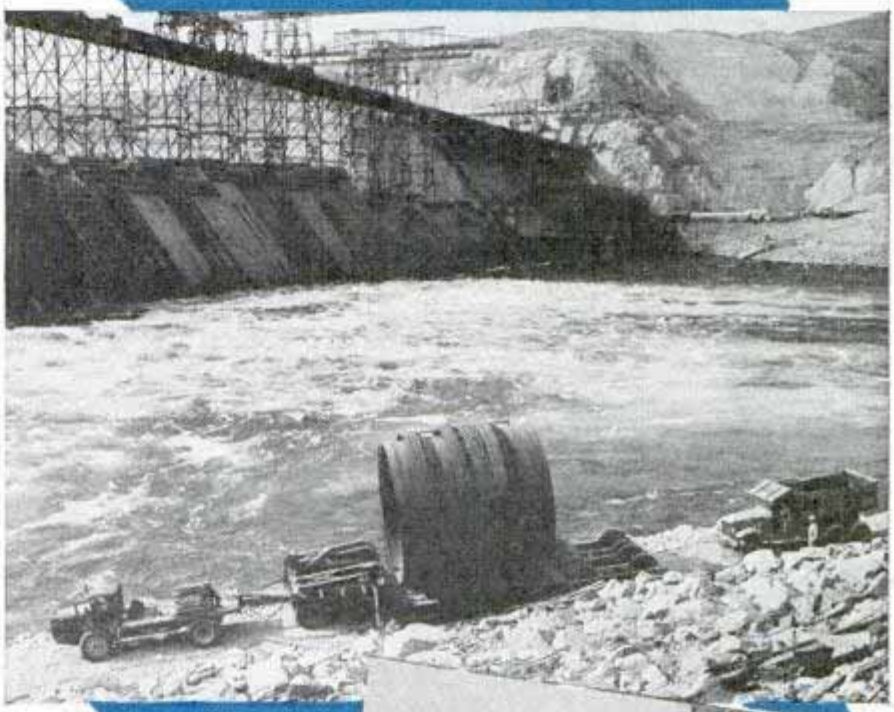
The second major benefit of the dam will be electric power. Under construction at the base of the dam is the world's greatest power plant, ultimately to consist of two buildings, each fourteen stories high and two blocks long, each housing nine generators and turbines. The initial installation will consist of one of the two buildings, three main generating units and two station-

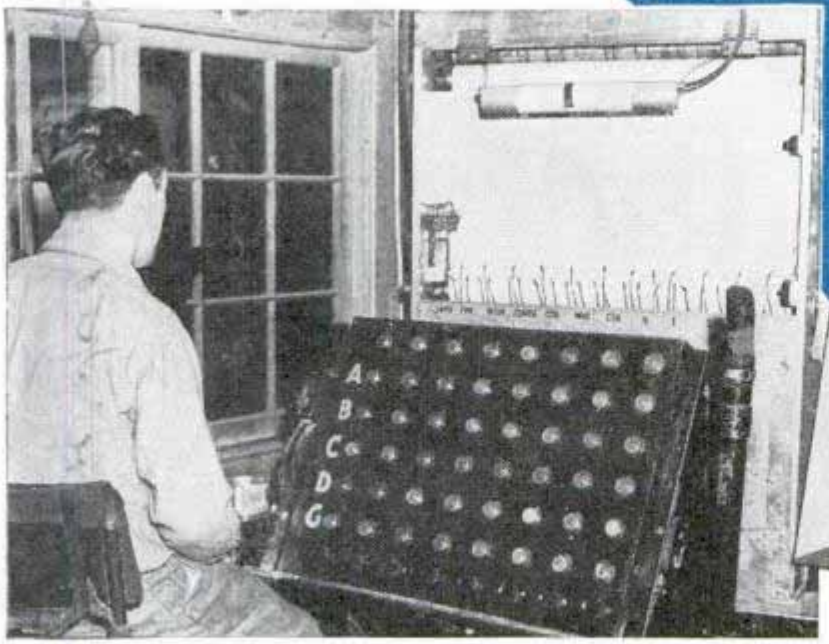
Top, left, giant concrete factory, capable of turning out enough concrete in one month to build two-lane highway more than 250 miles long. Right, watching for bedrock movements with aid of instrument combining levels, lenses and Mercoid switch. Bottom, brightly illuminated view of dam under construction at night

service units. The main power units will each consist of a 108,000-kilowatt generator and a 150,000-horsepower turbine. The two generating units for local service will each include a 10,000-kilowatt generator and a 14,000-horsepower turbine. The five generators are under construction by the Westinghouse Electric and Manufacturing company. One of the three initial generators alone will weigh about 1,000 tons and will have a stator and frame twenty-two feet high and forty-five feet in diameter. The parts of each generating set would fill a train of forty-five or fifty cars.

Aside from pumping needs, about 8,000,000,000 kilowatt-hours of firm power and an additional 2,000,000,000 kilowatt-hours of secondary power will be available and can be distributed economically through all of Washington and parts of three other states. It is estimated that all of this power

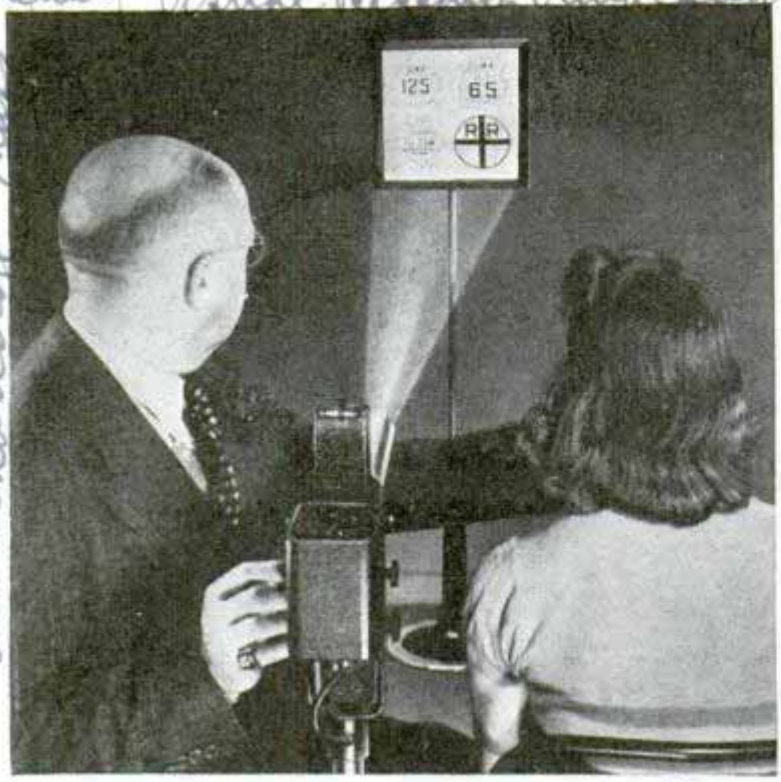
(Continued to page 130A)





Bottom, left, control board which makes mixing of concrete almost automatic. Top, two huge steel gates used for closing gaps in river. Center, truck (in foreground) is dwarfed by eighteen-foot penstock it is towing. Bottom, right, workers erecting trestle

Road Signs Cast on Screen to Examine Drivers' Vision



Road signs are projected on screen to test vision of drivers instead of using the customary chart that can be memorized

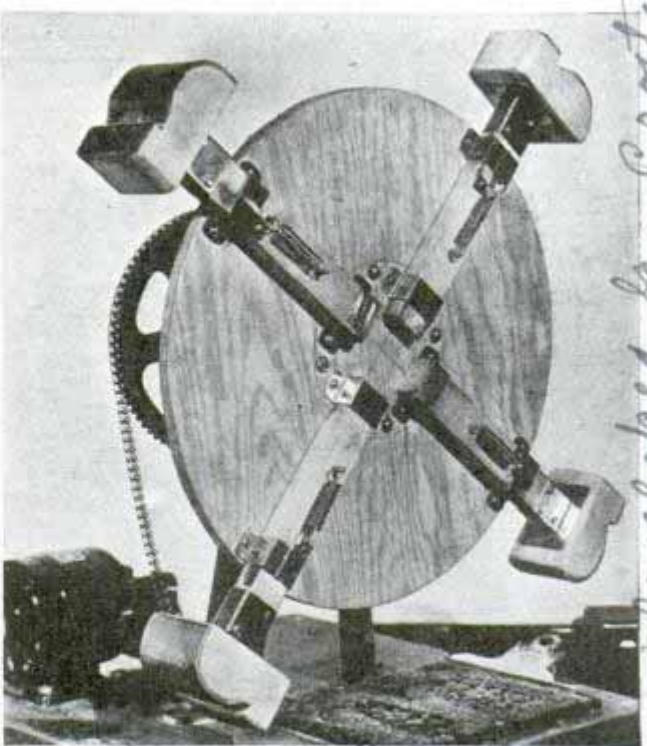
Instead of using the usual eye charts, Iowa and Kansas spot defective vision of automobile drivers by means of road signs projected on a screen. One purpose of the new system is to trap applicants for drivers' licenses who memorize ordinary test charts and letters, thereby passing tests even when their vision is below standard. Examinations are conducted under lighting that approximates natural outdoor illumination, and tests for literacy, sharpness of vision, astigmatism and color blindness are included.

Why Earthquakes Come in Groups Still Puzzles Scientists

Fresh discussions of why earthquakes sometimes occur in groups, with intervening periods of relative quiet, have resulted from the series of four severe shocks felt in widely separated parts of the earth within the span of a few days near the close of last year. In addition to the devastating quakes in Turkey, there were two centering off the Pacific shore of Costa Rica, and a sharp shock was felt in southern California. Seismologists of the U. S. coast and geodetic survey admitted that it may be possible for one earthquake to set off another, even in a remote part of the earth, but said that this could happen only if rocks of the earth's crust in the second locality were already in a state of severe strain. In such circumstances it is believed that waves from one temblor traveling through the earth's core might supply the push needed to precipitate the break. Other "trigger forces" being studied are the pull of the sun and moon on the earth's crust, strains produced by exceptionally high and low tides, and even pressure changes in the atmosphere caused by a shift from low to high barometric conditions which might amount to millions of tons over a large area.

Robot Feet Wear Out Rug to Test Its Durability

Wearing qualities of various carpet fabrics, and the best methods for cleaning them to prolong their life, are determined by tests made with a mechanical kicker. Four "boots" mounted on a wheel kick and scuff the rug surface as the machine is turned by an electric motor. Each leg fits loosely in brackets so the boot will shuffle across the rug, and as it rises a spring pulls it back into place ready for the next kick.



"Kicking wheel" with four feet that take turns shuffling across rug tests wearing quality of fabric

Many-Purpose Air Gun Sprays Molten Metal

Development of versatile spray guns which shoot a mist of molten metal has opened up a wide field of applications ranging from the metal coating of baby shoes to the rebuilding of dented automobile bodies and fenders. One of the newest guns for applying metals with a melting point of 1,000 degrees or less has a control needle by which the amount of metal sprayed can be varied from zero to two pounds per minute; the metal is melted in a crucible and siphoned through a stainless-steel orifice into the stream of compressed air. Since the metal is cool when deposited, it is possible to make accurate metal fingerprints by spraying the human hand. This method is used, too, for dental work, for reproducing patterns by spraying metal over the master pattern of wood, wax or plaster. Lead is sprayed over wood or metal where protection from fire or corrosion is needed. Tin is sprayed in food tanks, milk coolers and other containers requiring safeguards against contamination. Window signs and decorative panels on curtains or walls are made by spraying into stencils. One of the largest uses for lead-tin alloy metal spraying is in building up dented automobile surfaces.

Above, the spray gun and some of its accomplishments: filling dented automobile fender, coating plaque and covering lathe-turned wood with metal. Below, reproducing hand prints in metal

¶The average speed of all freight trains in the United States reached a new high of 16.7 miles an hour in 1939.

CAMERAMAN at the

Atop U. S. embassy roof, at upper left, the author films bombers in sky. Above, civilians throw up barricades in Warsaw street; below, effect of shell fire, which blasts holes in building but does not wreck it

By Julien Bryan

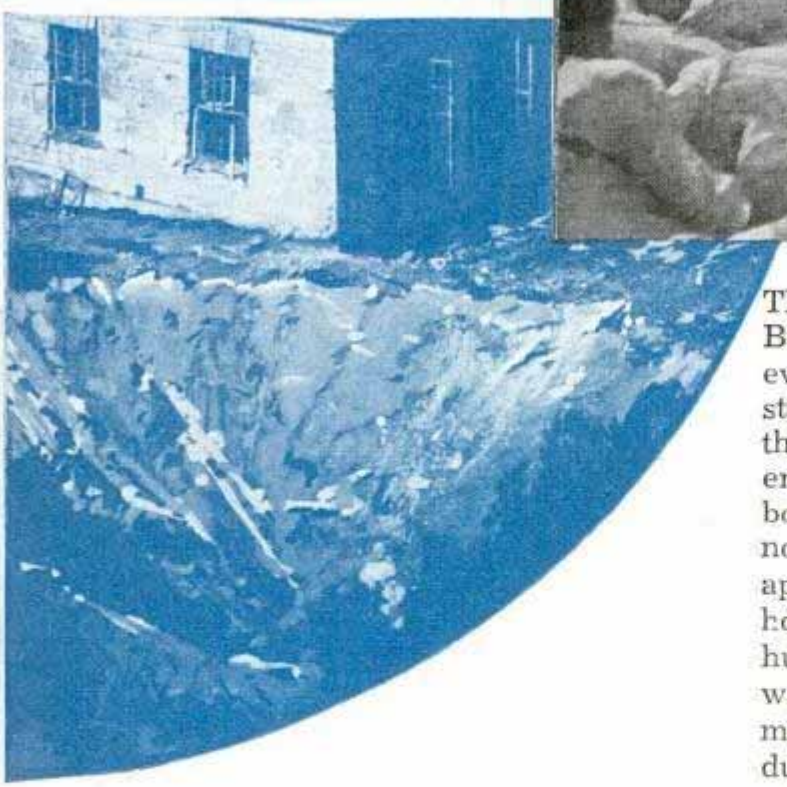
PART II

ONE day, as I stood in the garden of the American embassy in besieged Warsaw, I saw a German plane shot down directly overhead. By luck I filmed the entire picture of the bomber falling in flames. Good luck for me, for I was the only American cameraman in the city; but the end of luck for the German fliers.

As a decent human being, I suppose I should have been horrified at the sight. But I joined with two Americans in yelling and cheering. We had no thought of those aviators' families back in Germany; we knew only that they represented a government that for three weeks had been mercilessly killing people around us. That is what war does to you.

Behind the lines in 1917 with a camera I used to watch dogfights between French and German planes. It was interesting and exciting, and none of us was very much afraid of bombers then.

FRONT



Doctors and nurses attend mothers with new-born babes, above, right, on basement floor of a Warsaw hospital under bombardment. Left, Mr. Bryan comforts a girl whose sister has just been killed by machine-gun fire from plane; below, a thirty-foot bomb crater perilously close to a hospital

They were slow, their range was limited. Besides, the French and Germans were evenly matched. There was a different story in Poland. Each day we estimated the Germans sent over at least 2,000 bombers for two trips each—4,000 loads of bombs daily dropped on this little country, not only on military objectives but on apartment houses, schools, churches and hospitals. The mass attack was carried hundreds of miles in the interior. Railways and country roads were bombed and machine-gunned. No such thing occurred during the world war of 1914.

Still, there is encouragement and hope for Helsinki and London and Paris in the percentages tallied at Warsaw. There seemed to be few direct hits on objectives. Of a thousand bombs aimed at one bridge,

Polish soldier impresses pedestrians into work on street defenses, above. Below, Bryan, seated in his open military car, is cheered by Warsaw residents after showing his credentials to soldiers who suspected him as spy. His mother dead, boy at bottom sits forlornly in ashes of his home

ninety-five per cent missed entirely. Twenty per cent seemed to be duds. The moral for the rest of the world seems to be that despite the appalling damages from these mass attacks by air, they were quite insufficient by themselves to win the war. Every Polish airport was bombed out of existence within the first week, yet Warsaw could not have been taken without cooperation of German infantry, artillery and motorized units with the air force. So there is, in my opinion, little danger of complete conquest of England or France, let alone the United States, by an enemy air force alone. No one knows the number of planes the Nazis lost in Poland, but my guess is that seventy-five to 100 bombers were shot down, probably forty of them by anti-aircraft units around Warsaw.

The same day that I photographed the crashing bomber, I asked permission to take pictures of some German prisoners. It was quickly arranged and we drove to a large military prison and, with floodlights and cameras, entered a cell block where twenty Germans were held. They were mostly young, nineteen to twenty-five. For two hours I talked to them in their own language and took pictures. A strange feeling came over me. A little while before I had exulted as a plane crashed to earth. But here were human beings, pitiful fellows. We couldn't hate them. I asked one boy what he wanted; he burst into tears and said he wanted to go home. All of us smiled. We wanted to go home, too. Most of the prisoners asked for a razor and soap. I asked why they had attacked Poland. They answered:

Refugees, top, seek new shelter after homes are demolished. Below, interviewng Polish flier who has just shot down bomber

"We were forced to." They said they had been called out for maneuvers, not knowing Germany was going to war with Poland. They did not even know, that day, that England and France had declared war on Germany two weeks before.

During the latter days, as bombing and shelling grew worse, I found the only relief and the only safeguard against terrible jitters was to keep busy. Nowhere was life safe. Taking pictures was my job and I stuck to it. One day I went to the edge of the town where peasant families lived. Two bombers had just passed by, dropped their load and killed two women. There had been seven women in a field digging potatoes. Frightened, they had run in all directions, but the planes flew on, and the women, hungry, went back to their potatoes. In fifteen minutes the planes returned, power-dived, and as they drove past close to the ground they opened machine-gun fire and killed two more women.

A few minutes later, as I finished filming the scene, a little girl of eleven or twelve came running up. Kneeling beside her dead sister, a girl of twenty, she cried: "Oh, my sister, talk to me. Please come back to me, my sister!" She could not understand. I took a series of pictures, but finally could take no more. I put my arm around the little girl and tried to comfort her, but I cried, too, and so did the Polish soldiers with me.

Life must go on for those that survive. The women went back to their digging in the potato field. Nurses in the hospitals carried on while bombs fell. Few of the stores in Warsaw closed, unless they were wrecked. Even the newsboys stuck to their jobs while shells raked the principal

Rails driven into pavement, stone blocks and skeleton of street car form anti-tank barrier, top. Center, movie-making the morning after incendiary attack. Bottom, a heavy bomb, exploding after penetrating four stories, demolishes modern apartment

streets. Most of the public utilities functioned until almost the very end. The telephone kept going. To be sure there were no taxicabs, for these were taken by the army, and the street cars lasted only about ten days; after that they were used for barricades in the streets. The one radio station gave forth its brave little blasts to encourage the people day and night. Naturally the Nazis wished to put all Warsaw radios out of commission, and during the ten minutes when I made a broadcast, by invitation, to try to get news of the siege to the outside world, the building was constantly a target for bombs. Several shells fell dangerously near, and one hit while I was talking. I was just as well satisfied to leave that building.

People all over Warsaw got to know me and what I was doing. One day a Polish woman telephoned me that a German plane had just been shot down in her yard. Another time a call came at nine o'clock at night saying that the old Jewish quarter was on fire; I went with my camera and a new supersensitive film and got some striking pictures of the fire. Each evening about 5:30 German planes would come, pick a certain area and drop their load of fire. All night Warsaw would be lit by a great torch, ten to twenty blocks in flames. By morning 5,000 more would be homeless. My camera would spot an old woman in a daze, poking among the ashes of her home; an iron bedstead, bent and blackened; a little girl

clutching her dog; two boys reading a Polish edition of Mickey Mouse. All these people saved first of all their bedclothes and a little food. You had to keep warm, you had to eat. Thousands cooked and slept outdoors. I am not primarily a war correspondent, but a peacetime reporter with a camera, going around the world photographing people. That is what I tried to do in Warsaw, and would do at any front. The great story there was what happened to the old men, the mothers, the babies, the civilians who kept at their jobs. The pictures of which I am proudest are the closeups of a brave people in agony.

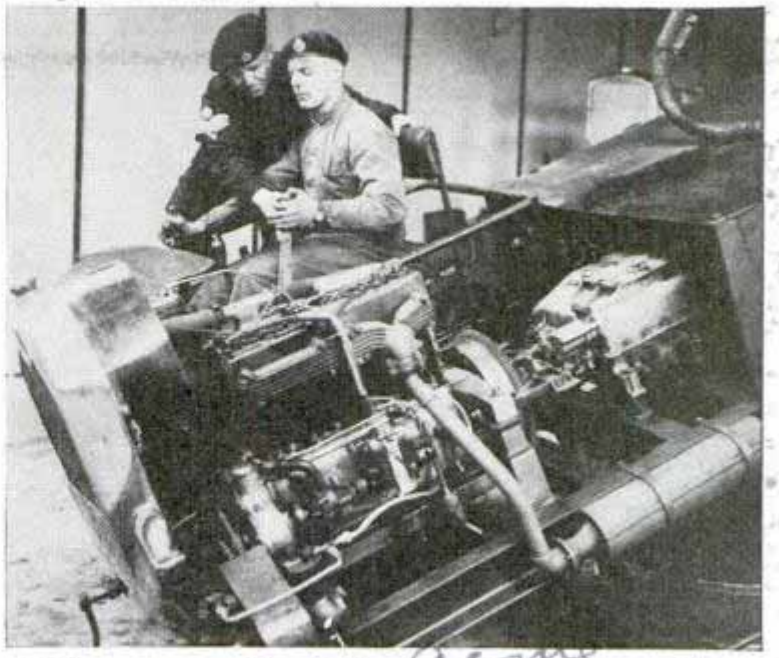
All this time, of course, we Americans and other foreigners scarcely dared think whether we would ever escape from the encircled city. Mayor Starzynski said to me one day that "it would be a wonderful thing for Poland if your films could be taken out now. Then the world would know what the Nazis have done to Warsaw. If we can get you a plane, would you care to go?" I nodded. The mayor sent an aviation officer to the nearest field to try to get a plane. He never returned.

Then at 1:30 on the afternoon of Sept. 21 came the news that from two to five o'clock hostilities would cease and all foreigners would be evacuated. No one was permitted to take more than one small suitcase, and I had to leave behind $2,000 worth of cameras and equipment. Films took up most of the space in my bag, so I forsook also nearly all clothing.

Promptly at two, some fifty automobiles and eighty army trucks assembled. We waited two hours for stragglers, until there were 1,200 of us, of thirty nationalities. Not until 4:30, a half hour before the truce was to end, did the trek start. We passed a mile of ruined houses, occasionally saw a half-hidden three-inch gun. Three and a half miles from Warsaw's center were the Polish front lines, beyond

(Continued to page 139A)

Recruits 'Drive' a Dummy Tank at British Training School

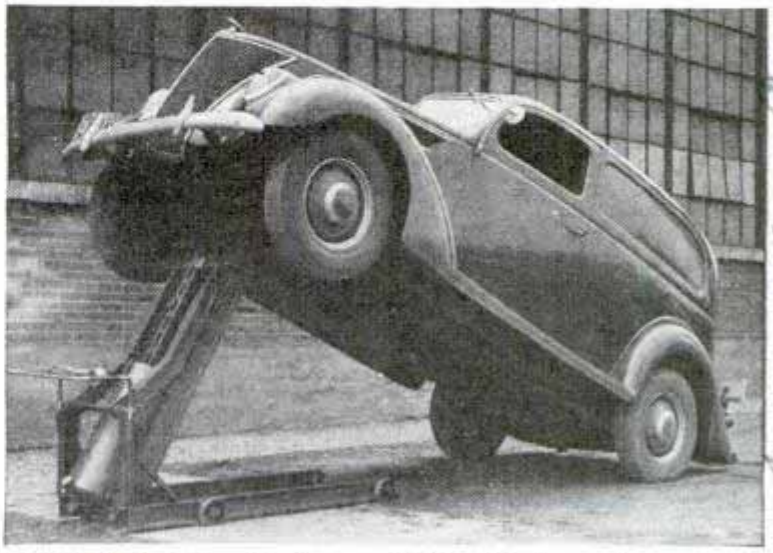


Stationary war tank in which recruits learn the art of driving

At the British Royal armored car school, recruits practice on a stationary "dummy" apparatus in learning to handle the controls of an army tank. This is part of a twenty-four weeks training course given men before they are assigned to the front.

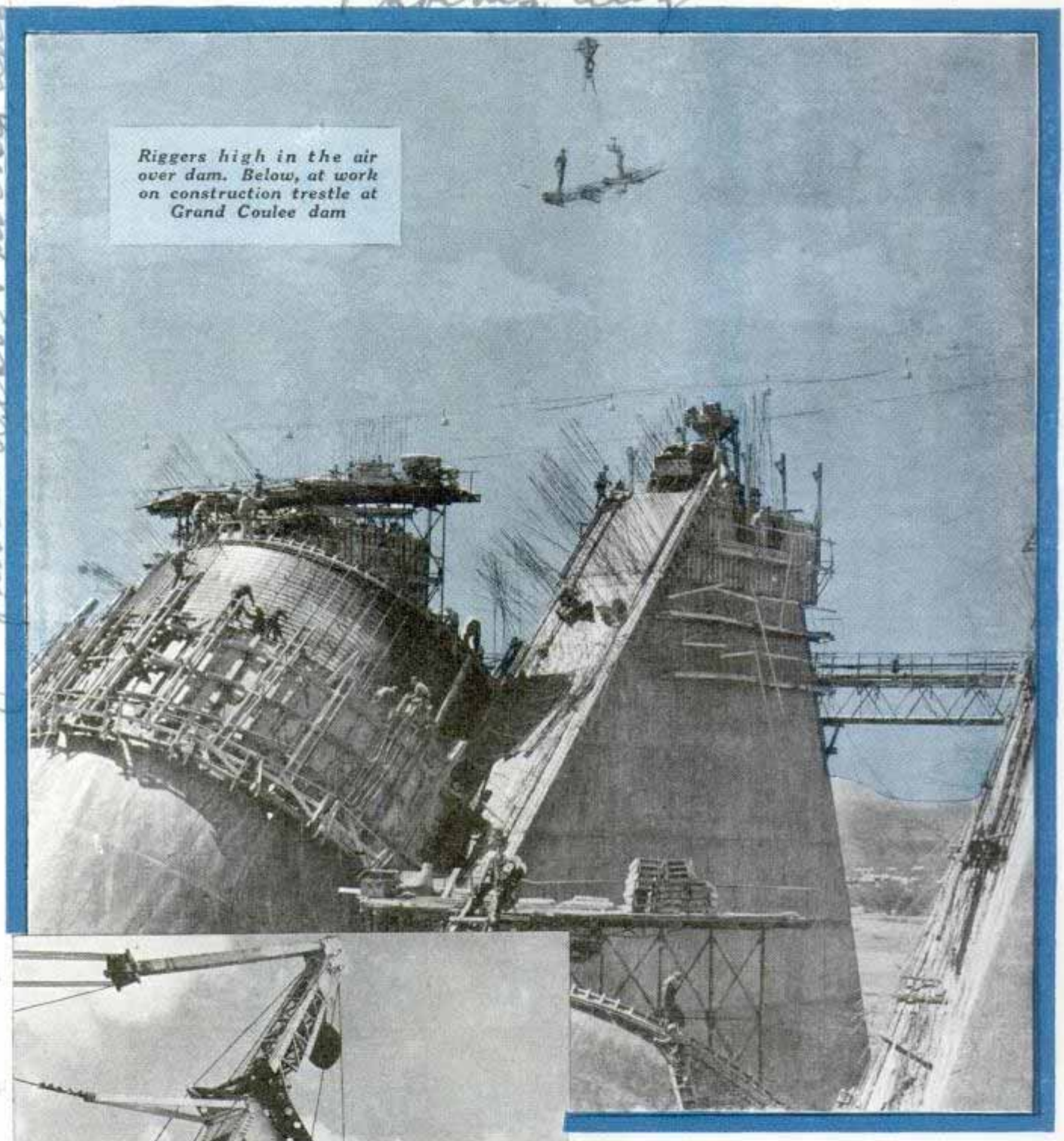
Air-Powered Jack Raises End of Car to a Height of Five Feet

With little physical effort on the part of the user, a portable lift powered by air will raise the end of a car or truck to a height of five feet. Designed for use at service stations and garages, the jack rolls easily on its wheels and can be used indoors or outdoors wherever an ordinary air hose will reach it. Being set low, the lifting arms and cradle can be placed under either the front or the rear axle.

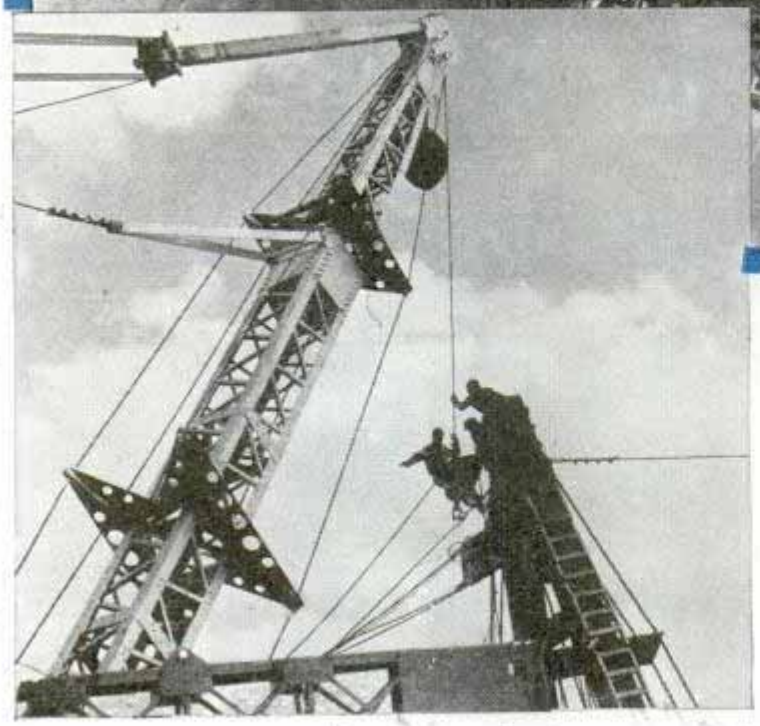


Powerful air-jack raises front end of car for inspection or repair

IN THE AIR

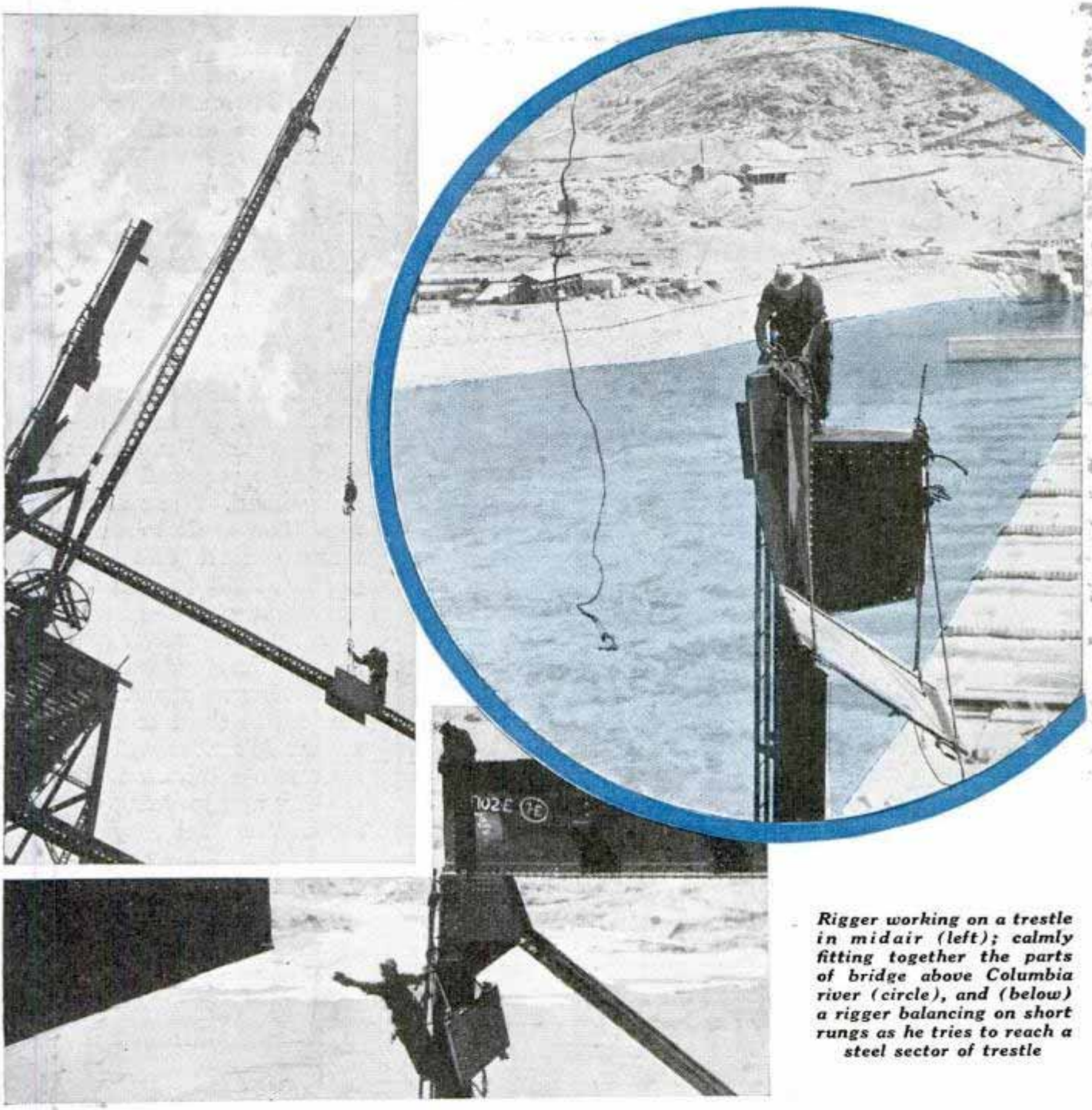


Riggers high in the air over dam. Below, at work on construction trestle at Grand Coulee dam



FROM his perch atop a load of lumber 100 feet in the air, a figure waves two small paddles, signaling the high-line "skinner" below. Suddenly he stumbles and falls, catapulting to the river below. Rescuers quickly drag him out, unconscious but alive. After treatment at the camp hospital, the man again takes to the high line. Just another incident in a rigger's day.

with the RIGGERS

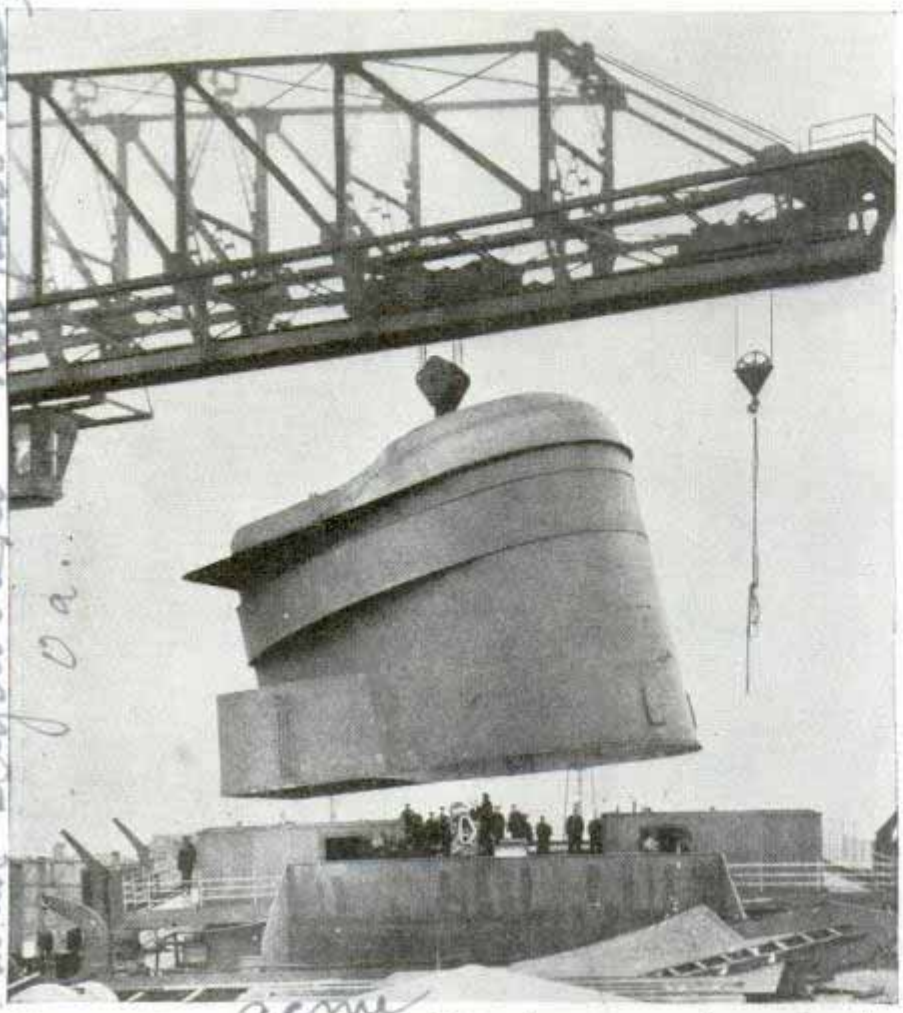


Rigger working on a trestle in midair (left); calmly fitting together the parts of bridge above Columbia river (circle), and (below) a rigger balancing on short rungs as he tries to reach a steel sector of trestle

Working on the large dams, riggers daily entrust their lives to a two-inch cable and their own sure-footedness. Wherever material is to be transferred from one sector of the dam to another, riggers are at work. Every dam has its peculiar rigger-job angles. Bartlett Dam, the world's highest multiple arch dam, had two towers at either end of the dam and 1,600 feet of cable was stretched from the head tower beyond the spillway gates to the tail tower on the other side of the dam. The ends of the cables, running through the two towers and back again and over the tops of the towers, are embedded in concrete. A large carriage, rolling over the cables on wheels, supports the hoist, which grips cables used to tie up the material to be moved to the dam. From a cable house, a high-line skinner operates the winch that raises and lowers the riggers with their load. In his hands lie the lives of many workmen. A wrong reading of the rigger's signals, 400 feet up in the air, may result in a false move of the carriage and a consequent cat-

(Continued to page 136A)

Wings on Ocean Liner Stack Deflect the Smoke from Deck



Giant traveling crane moves funnel into place on ocean liner undergoing construction. Note wings above stack designed to deflect smoke from deck

Smoke rolling from the streamline funnel of the new United States Lines ship "America" will be deflected away from the sports deck below by means of funnel wing tops designed for that purpose. A crane capable of lifting seventy-five tons swung the two stacks in place. One is a dummy and houses an emergency generator and equipment. The new liner, largest ever built in this country, is 723 feet long and will carry 1,219 passengers.

Railways Abandoned 1,783 Miles of Track in U. S. Last Year

Fifty-eight miles of new railroad lines were built in the United States during 1939, but 1,783 miles were abandoned. In Canada just one mile of track was constructed, and 151 miles abandoned. Ever since 1917 there has been a heavy abandonment of trackage in this country, averaging more than 1,000 miles a year. This trend has been especially noticeable in the last eight years, during which 645 miles of track were laid in the forty-eight states and Alaska while 13,508 miles were abandoned. In this period Missouri led with 797 miles abandoned, Texas was next with 726.

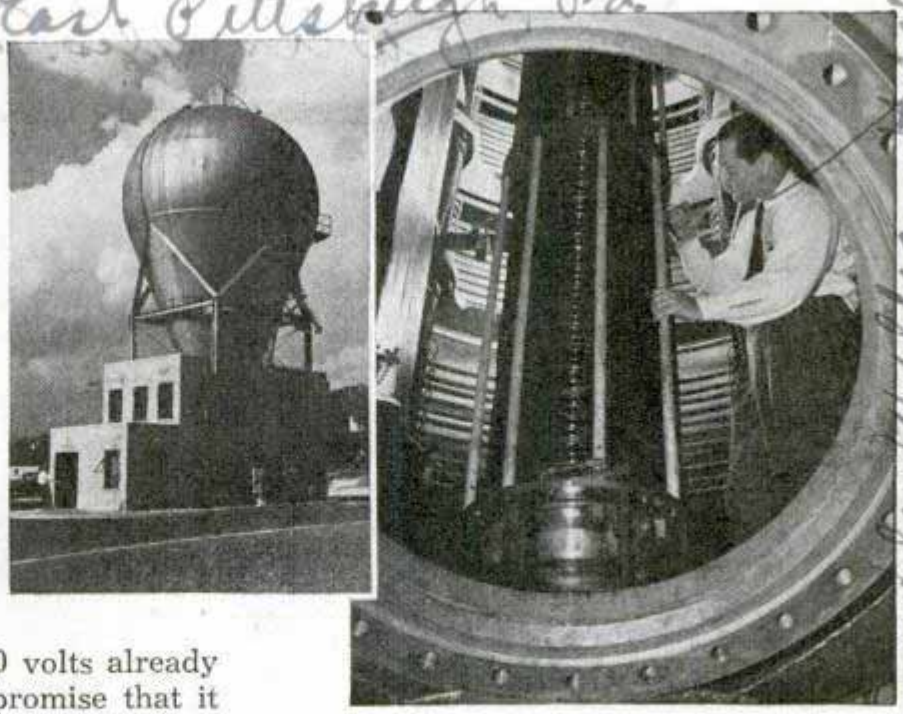
Lightweight Sander Is Operated with One Hand

Operating at 4,000 revolutions per minute, a portable electric sander can finish a job in a fraction of the time that would be required to do it by hand. The midget machine weighs only three and one-half pounds, light enough for operation with one hand, and it uses a quarter of a sheet of the standard nine by eleven sandpaper. According to the manufacturer this sander will not mar the surface with chasing and graining effects. The tool may be used for rubbing or polishing by substituting cloth for sandpaper.

In the lightweight class, this electric sander can be guided with one hand and works at high speed

Four Million Volts Smash Atom for Its Secrets

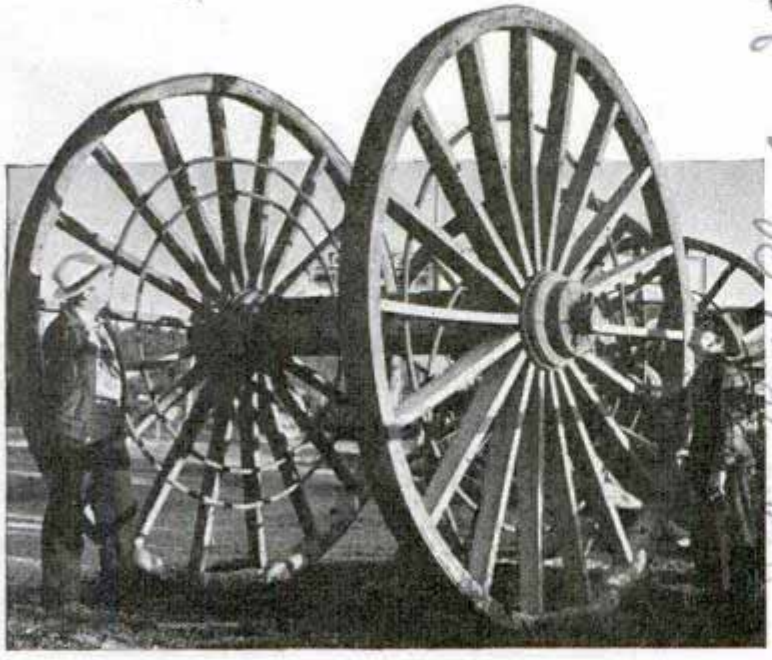
Seeking to unlock more of nature's secrets, science has constructed a new key in the form of the ninety-ton atom-smasher at Westinghouse research laboratories. The forty-seven foot pear-shaped steel tank, housing a forty-foot vacuum tube, breaks up atoms into their smallest parts, and hurls these parts at speeds from 30,000,000 to 100,000,000 miles an hour at the very heart of matter. The driving force behind these "bullets" is electricity. A potential of 4,000,000 volts already has been attained, with a promise that it will exceed 5,000,000 volts. To build up this high voltage, small charges of electricity are sprayed onto two sixty-foot conveyor belts at the bottom of the pear-shaped tank and carried rapidly to the top where they are removed and stored up on a giant metal hemisphere or electrode. When the accumulated energy is released, it sends charged particles flying at the target at the bottom of the tube. By piercing the cores or nuclei of atoms, the atoms are unbalanced or blasted to bits. This sort of atom juggling has led to the creation of synthetic radium by producing temporary radioactivity in various elements.



Left, forty-foot "cannon" that wrests secrets from atom. Right, testing vacuum tube for possible leaks

Big Wagon Wheels Attract Motorists to Filling Station

Curiosity of motorists who pass through Lakeside, Mont., is aroused by a group of massive wagon wheels that once were used to haul logs from the forest to the sawmill. The wheels have been set up as an advertising stunt by the owner of a gas station.



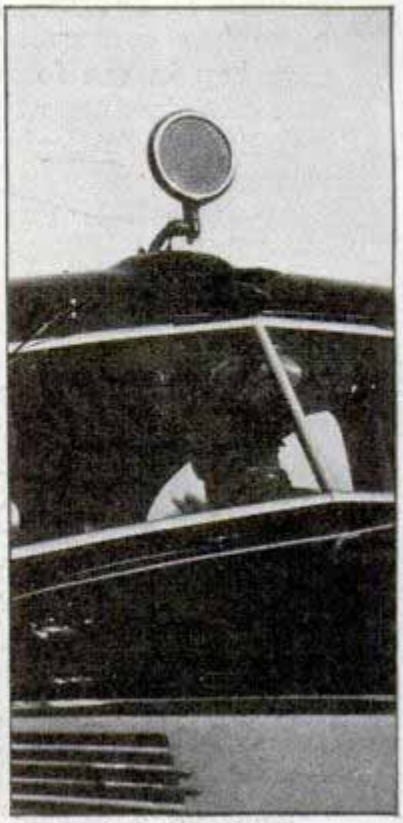
Relics of logging, these great wheels draw customers to gas station. Compare them with men in picture to get idea of size

'Daylight' Photoflash Bulb Used with Color Film

Night color pictures as good as those obtainable in natural daylight can be taken by camera fans with a new photoflash lamp now available. Coated with a corrected blue filter lacquer, it is designed for use by either the synchronized or open-flash method. A General Electric development, the light is scientifically matched for use with outdoor color films.

Twenty new streamline trains built during 1939 brought the fleet of "luxury liners" on American railroads to eighty-two.

FIGHTING CRIME

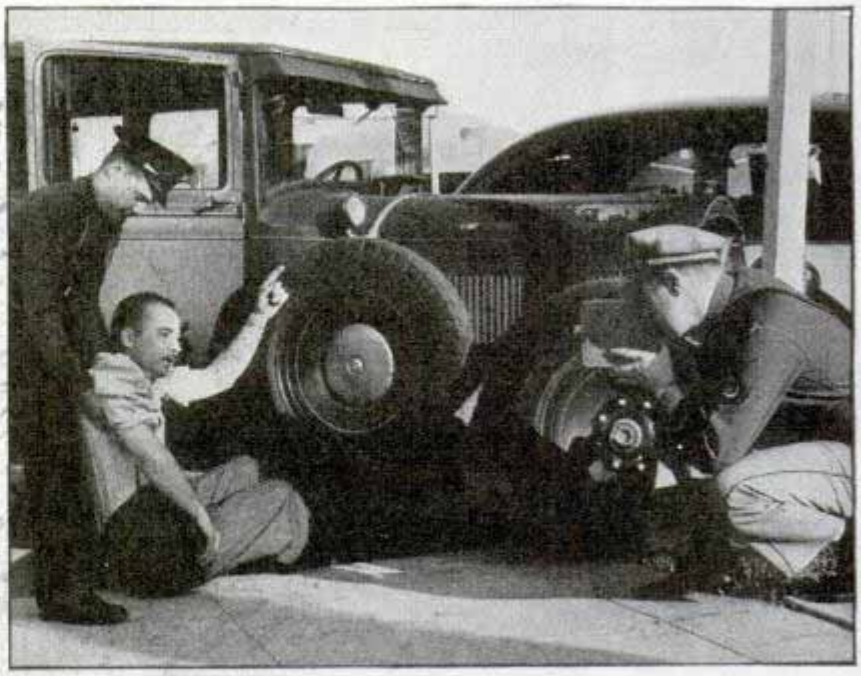


AMERICA is arming swiftly for defense against crime. Twentieth century weapons—radio, movies, electric transmission of pictures, wireless Teletype—have transformed the old-fashioned police patrol into a mobile laboratory to intercept the fugitive lawbreaker, take evidence, do everything but present the case in court.

It was within the last decade that newspaper photographs began traveling by wire and crossing the Atlantic by radio, and today police cars can exchange photographs, fingerprints and maps with headquarters by means of portable two-way radio scanners.

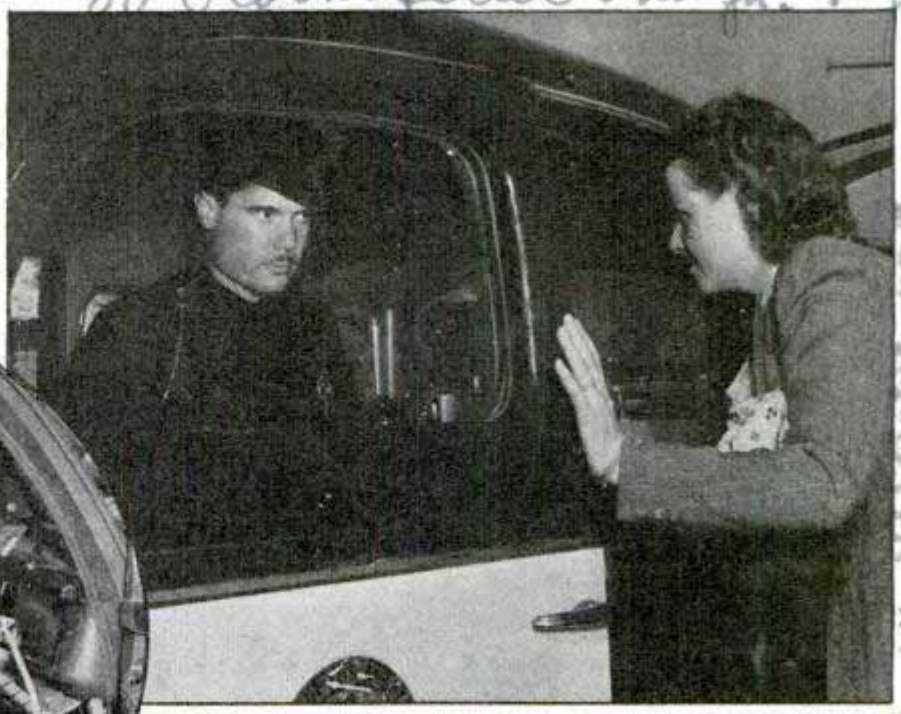
Far from its home base, a roving squad car reaches the scene of a murder. The only clue discovered is a fingerprint. Preparing it for transmission, the officers place the fingerprint before the scanning head of the mobile radio facsimile transmitter built into the dashboard of their car. At headquarters is a sending-receiving machine identical with that in the squad car. A sheet of paper resembling a telegraph blank, but with a graphite-coated back, is ready on the receiving drum and begins to turn automatically as the squad's signals come in. Line by line the fingerprint appears on the sheet as the electric stylus moves along the revolving cylinder.

As soon as the machine stops, the copy is ready, no darkroom work or chemical preservatives being necessary. The print

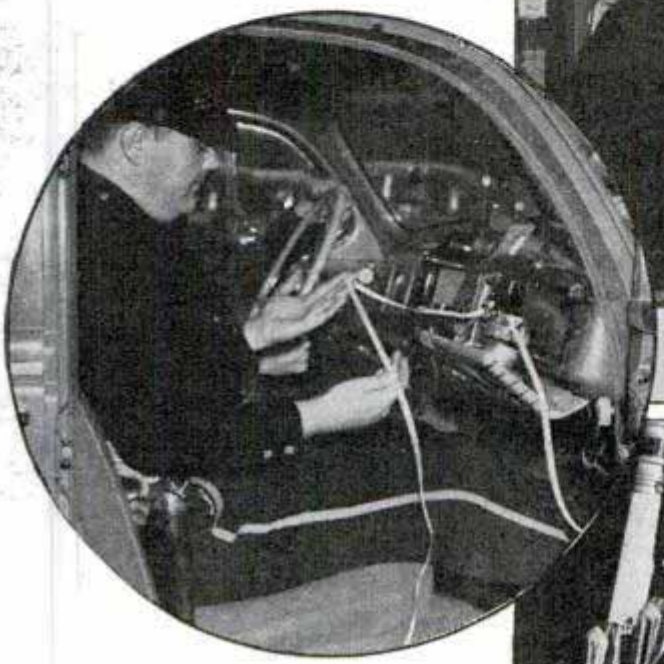


Top, movie camera installed in roof of police car to film traffic violations is invisible from front. Below, police demonstrate ***how they would photograph a motorist involved in accident***

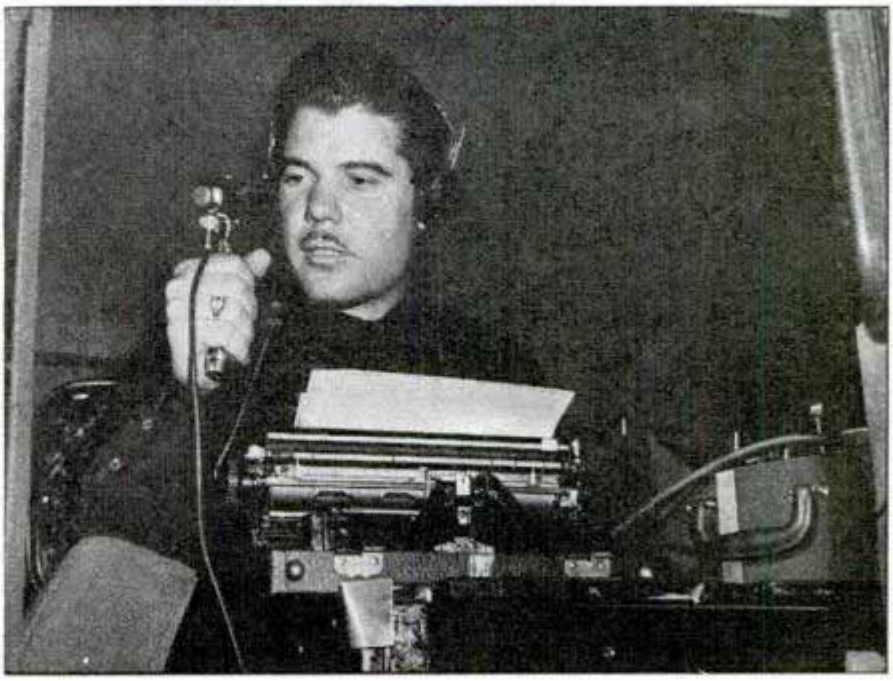
by REMOTE CONTROL

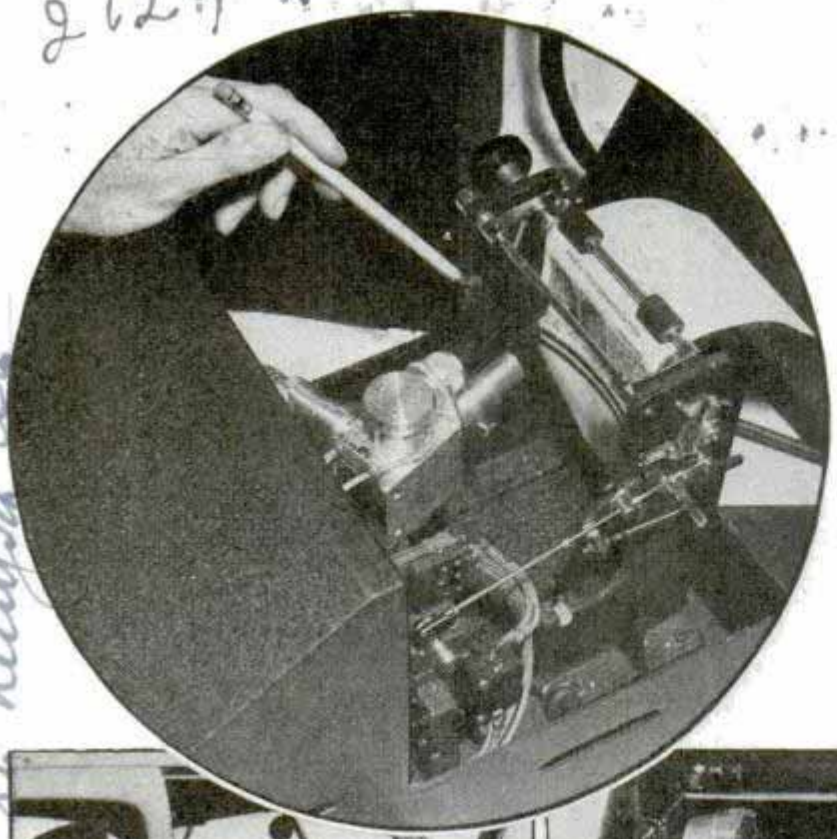


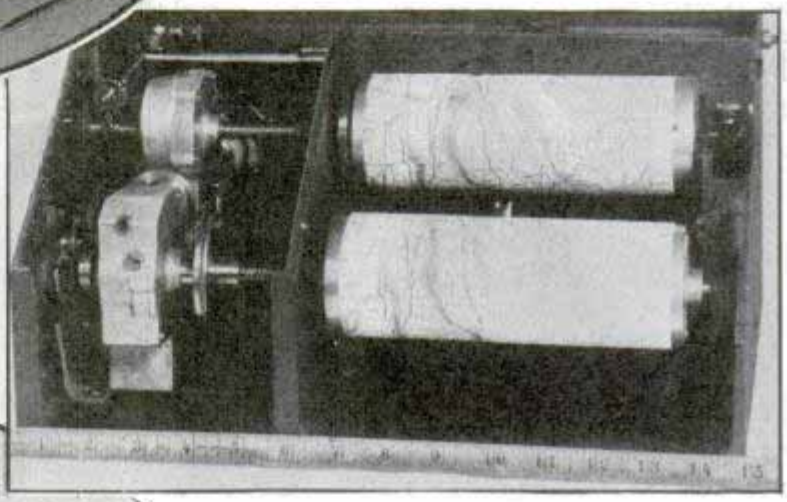
***Officer in patrol car,** below, **reads message on Teletype ribbon. At right, witness** dictates **statement which is** recorded **on sound equipment; notice** tiny **microphone on** policeman's coat, **center. Bottom, talking to headquarters on** two-way radio

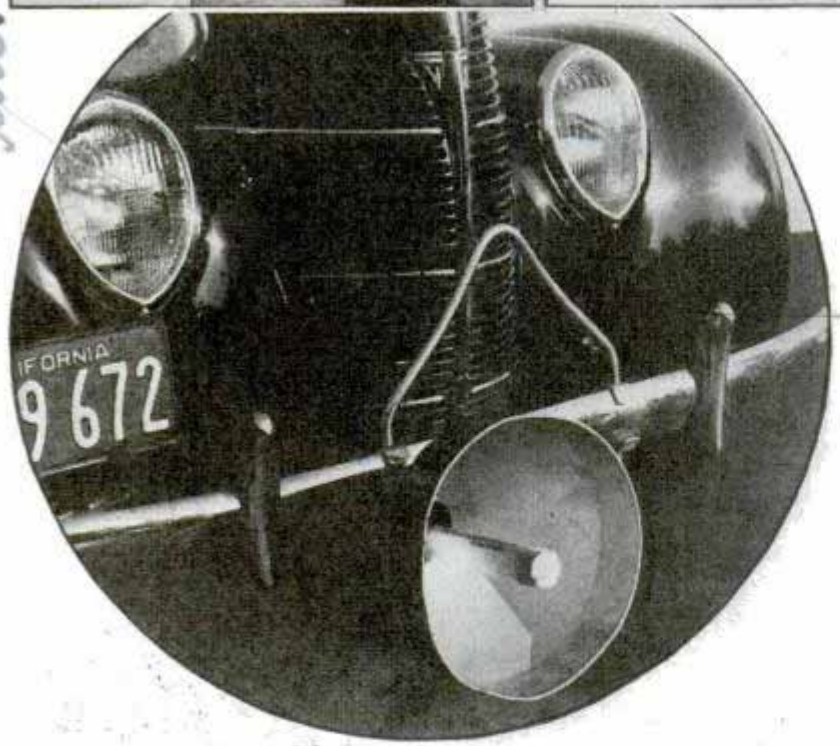


is turned over to the head of the bureau of identification. He studies it, goes to a steel cabinet, pulls out a set of fingerprints bearing a bright-colored tab, and through a comparative microscope checks it with the one just received. There are twenty-five points of similarity between it and the right index finger of a police character arrested before on a burglary charge. Accordingly, the wanted man's picture, description, and other data are placed on the transmitting drum of the machine and flashed to mobile units, highway troopers, sheriffs, and other law-enforcement agencies of the surrounding territory, with the result that









Top, three views of two-way radio facsimile sets which transmit maps, photographs, fingerprints and messages between headquarters and patrol cars. Bottom, flare in reflector for night photography

a dragnet is seining the streets and highways before the fugitive has gone very far in his flight.

With mobile send-receive facsimile equipment, investigations formerly consuming days are reduced to hours, the three and four-hour check-ups to minutes.

If a posse is hunting a criminal, squad cars could be concentrated at an out-of-the-way place by flashing directional maps to the mobile units from headquarters or from a reconnaissance car. Likewise, an air patrol might spot a hideout of a gang and transmit a map to a ground squad for a surprise attack. The growing trend of directing traffic for big events, such as the Rose Bowl game, by radio from the clouds may also call for specialized application of facsimile. W. G. H. Finch, who developed the mobile facsimile set, points out that police departments are using facsimile to send written instructions to patrolmen. If an officer has to leave his car for a few minutes and fails to hear a radio message the equipment assures him of the complete written order upon his return.

For ordinary police messages, the facsimile equipment can be utilized as a telegraph-

ic printer, handling typewritten copy at the rate of 150 words per minute.

In Los Angeles, cars of the accident-prevention squads are being equipped with movie cameras and microphones that take down the statements of witnesses on wax disks for presentation in court. Concealed in the car roof is a thirty-five millimeter motion-picture camera with a revamped shutter operating at 1/120 second, in comparison with the ordinary camera which records at one-thirtieth second, thus overcoming the vibration of the car and presenting a clear negative. The camera is synchronized with a precision speedometer and a stop-watch to record the speed of the car in rods so that every time a rod of roadway is covered the numbers click over. The resultant reel offers unassailable proof in court of speed violation.

In addition to the photographic equipment the car carries three microphones, with 100-foot extensions, and a sound-mixing panel. This is used to record, on the spot, testimony of witnesses. A lapel microphone, smaller than a police badge, and easily concealed, is worn by the questioning officers. The recorded statements of witnesses are then played back, typed on a portable typewriter, and made ready for signature by the witnesses. The mixing panel enables the officer to segregate the voice of one person speaking in a babble of voices.

For photographing evidence at night, two-minute flares, set in large reflectors, are attached to the front of the car. They are set off electrically from the dash.

Los Angeles police cars respond to an accident call in from one and one-half to two minutes, anywhere within the 400 square miles of the city's area. Now, in addition to their record for promptness, they hope to show a record of consistent conviction on serious traffic charges.

The slowness with which alarms were spread used to be a great handicap to police after a bank was robbed or a car stolen. By the time circulars could be printed and mailed the bandits would be hundreds of miles away, and even if alarms were telephoned or telegraphed, the police could only guess at the direction in which the lawbreakers were fleeing.

But recently the Teletypewriter has been helping to wipe out the bandit's head start on the police. In the northeastern

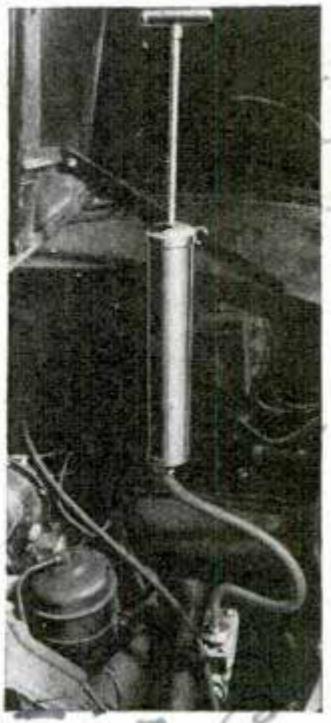
(Continued to page 120A)

'Blackout' Lamp for London Shines with Subdued Light

New lamps for London help those on streets but their glow does not lend aid to enemy air raiders at night

Modified street lighting is returning to London, darkened by "black out" since the war started. The lamps are specially fitted to direct all illumination groundward. While providing light on the streets, their beams give no help to hostile aircraft.

Hydraulic Brake Line Freed of Air by Hand-Operated Pump



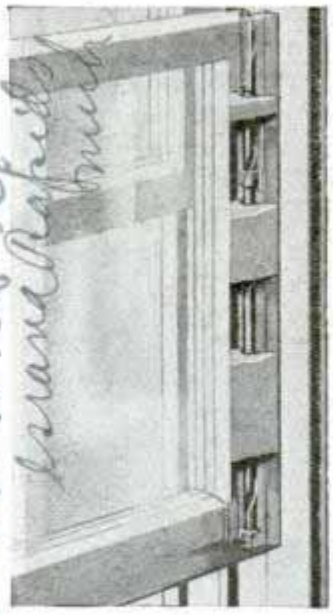
Air pockets, which appear in hydraulic brakes when repairs are made or brake fluid reserve is low, are removed from the lines and cylinder by a hand-operated pump, thus materially increasing the efficiency of brake operation. Working under an air pressure of twenty pounds, the pump forces new fluid into the braking system.

Handy Meat or Bread Slicer Makes Thin or Thick Cuts

Bread being sliced to uniform thickness on hand-operated slicer that will cut meat, fruits or cheese

Meats, vegetables, fruits, cheese and bread are sliced readily on a hand-operated slicer for the home. Food placed on a sliding holder is moved back and forth across the edge of the circular knife as the handle is turned. Slicing thickness is adjusted easily from paper thin to one inch.

Spring Window-Sash Balance Takes Place of Weights



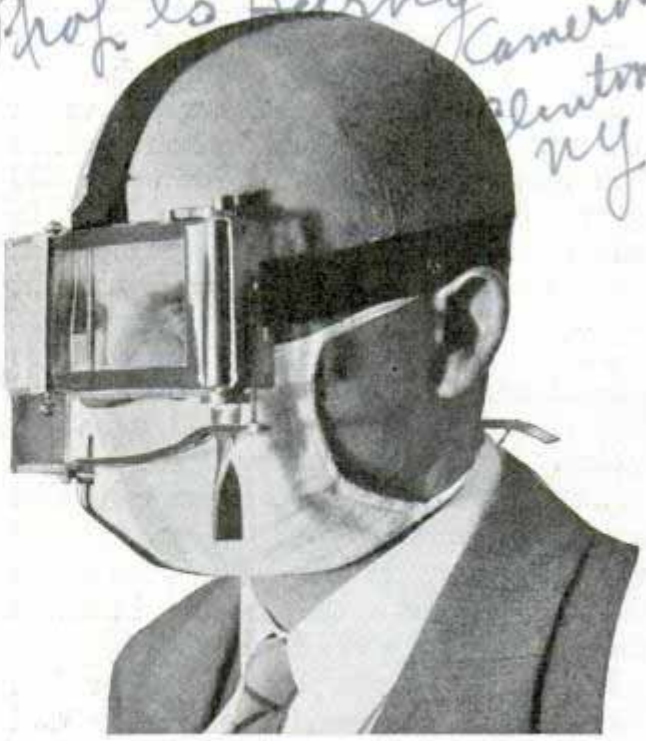
Doing away with counterweights, ropes and pulleys, a spring sash balance is invisible when installed. It consists of a tubular swivel arm with a spiral spring inside, and a bearing through which the former rides. For installation both sides of the sash stiles are plowed the entire length, five-eighths of an inch wide by three-quarters of an inch deep. In this groove is fastened the swivel arm. The bearing bracket is screwed to the jamb when the sash is in place and serves to hold the window open in any position. Tension of the spring can be adjusted with a screwdriver by means of a slot provided at the bottom of the swivel arm.

Earth Gains 100,000 Tons a Year from Falling Star Dust

This earth of ours is gaining weight. Every year it picks up at least 100,000 long tons of meteorites which fall on the earth, Dr. Fletcher G. Watson, Jr., of Harvard College Observatory reports, and the total may amount in some years to 10,000,000 long tons of microscopic "star dust."

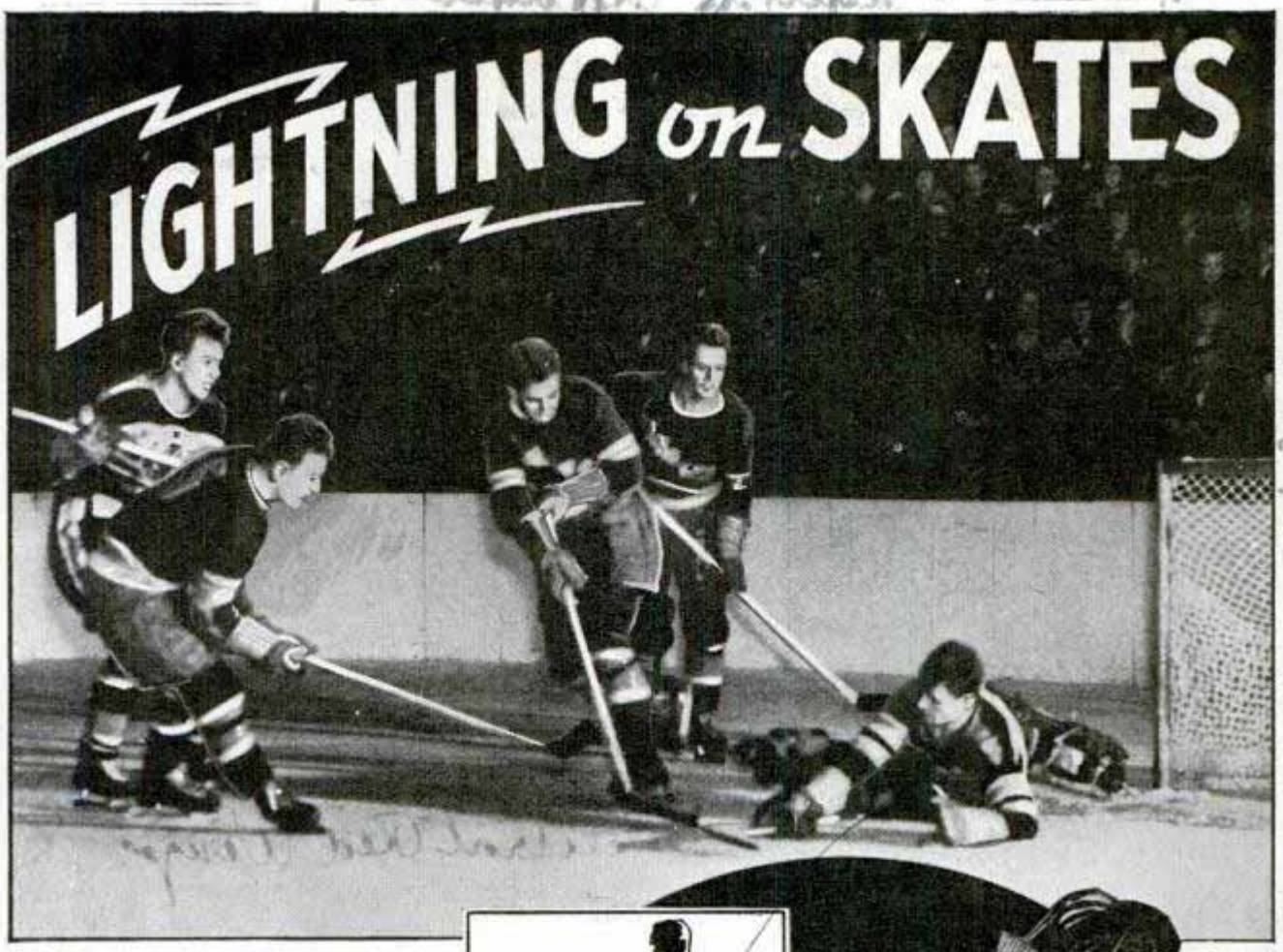
Doctor's Self-Cleaning Goggles Wind Up When Fogged

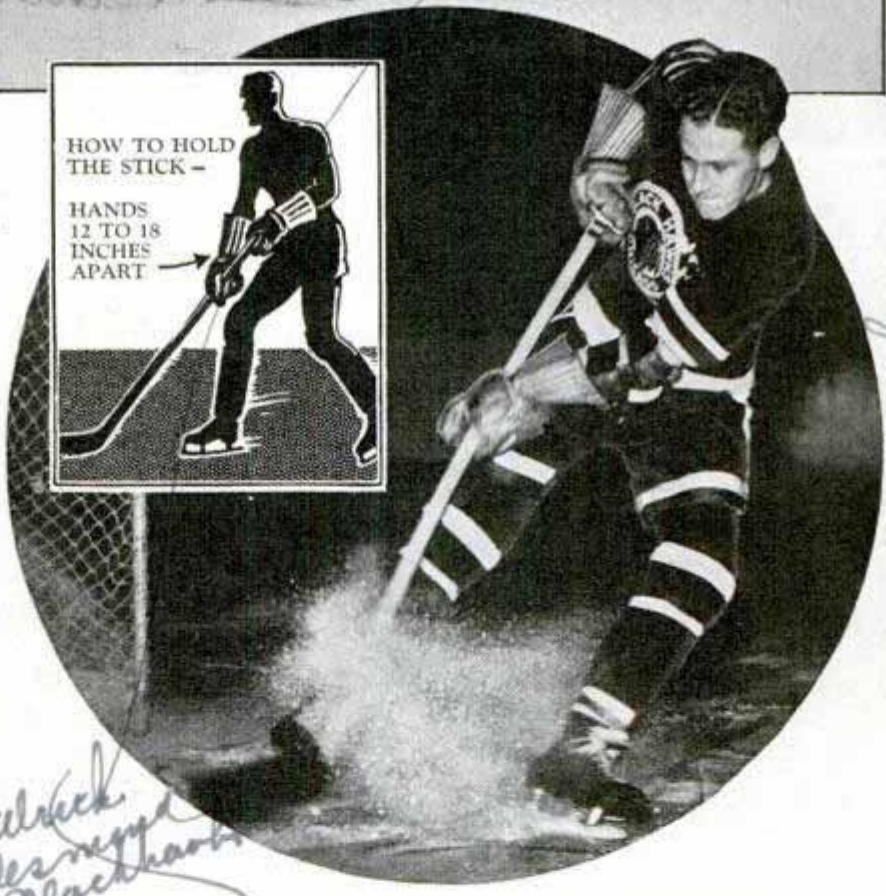
Nearest thing to goggles with windshield wipers is the self-cleaning pair invented by a Hamilton college professor of physics and a Utica doctor. What the doctor needed was a pair of goggles that would not fog at a critical moment when he was examining a patient's bronchial tubes or hunting for a swallowed safety pin. The self-cleaning goggles consist of a four-foot length of transparent film mounted on two rollers. The receiving roller has a winding mechanism worked by a crossarm; when the doctor moves his jaw downward, a clean film is pulled across the goggles.



Movement of doctor's jaw pulls clean length of transparent film across goggles while he works

LIGHTNING on SKATES





Top photo, goalie on the ice as he fights to prevent a score. Below, "Des" Smith scoring after inveigling goalie out of position

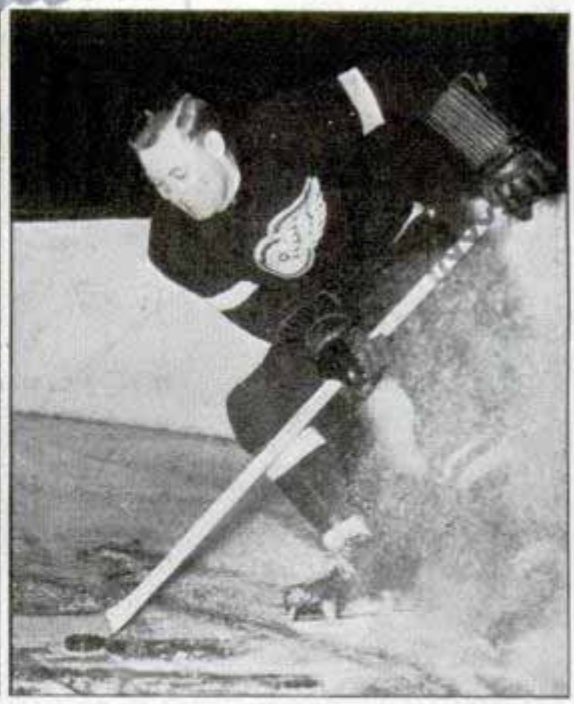
By Paul Thompson

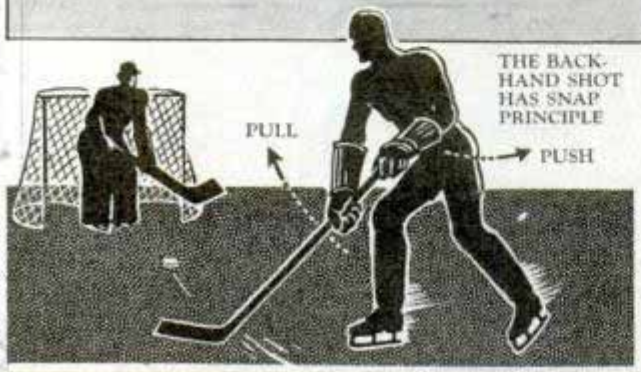
Manager, Chicago Black Hawks
National Hockey League

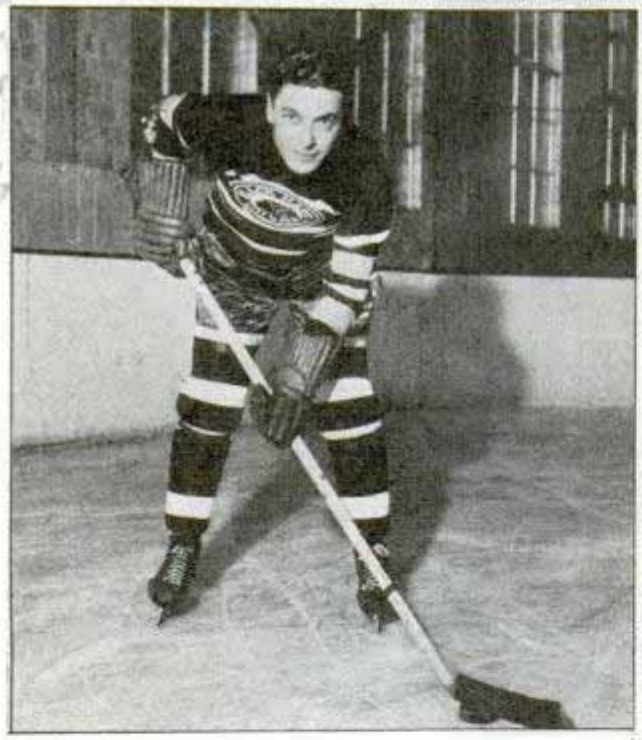
PLAYED at such speed that it is frequently called "Lightning on Skates," hockey attracts millions of fans every year to games played by professional and amateur teams. From players it demands the utmost in energetic endeavor, coupled with mental agility in which the mind must translate impressions into action in the winking of an eye. Only those who can think and act in a split second, and who have physical endurance, good judgment and accuracy can win places in the hockey hall of fame.

To become a big-league hockey player the individual must be able to skate superbly well. There is no "best" style. Each player has his own. He may favor short strokes, or long ones. It is up to him.

Your top-notch player must be built for endurance. That does not mean he must be a heavyweight. But he must be able to take the grueling punishment that is hockey. In the thirteen years that I played in the National League—five years with the







Top, left, goalie kicks puck away to prevent score. Right, "Mud" Bruneteau, one of hockey's outstanding players, receiving a pass. Photo at bottom, the author demonstrating technique of pass, with puck near heel of stick for proper directional control

New York Rangers and eight years with the Chicago Black Hawks before becoming manager of the latter—I found that it was a common thing to lose nine to ten pounds in weight during a game.

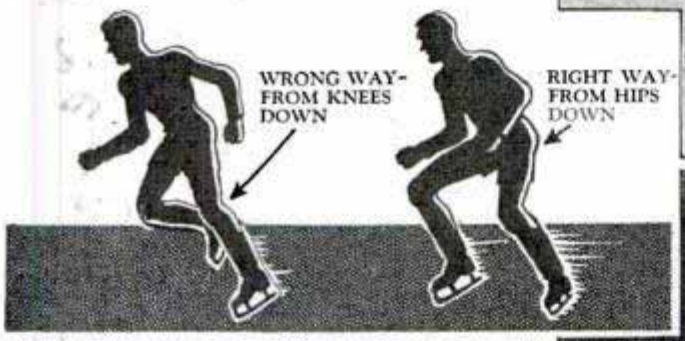
Big-time hockey also means high-speed skating at crucial moments. In fast action a player will streak down the ice at better than thirty-six feet a second. During a game he probably will skate ten miles. It takes stamina, plus skating skill, to do that.

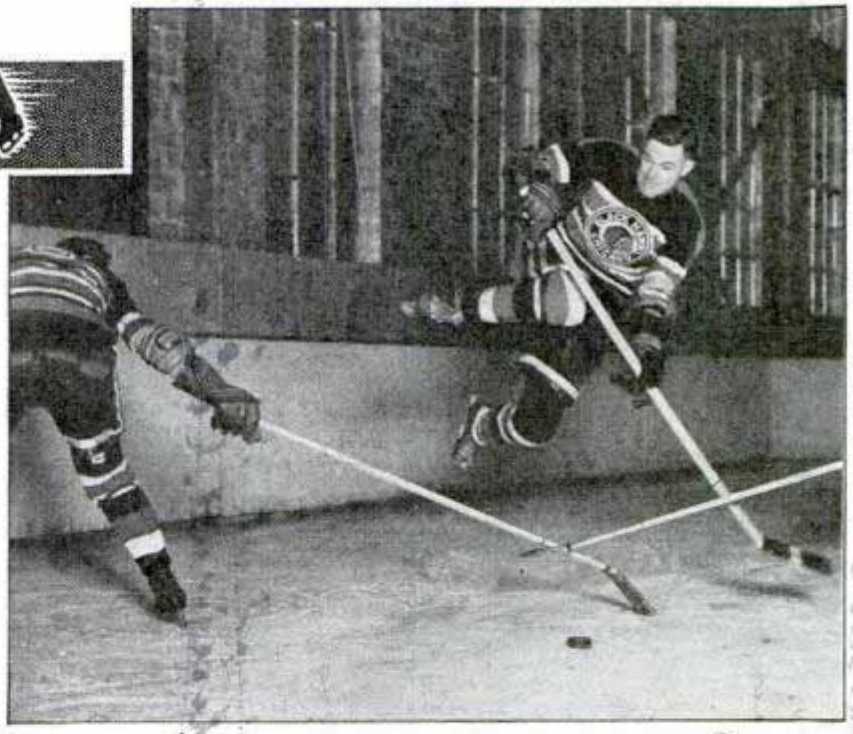
The boy who can stand on a pair of skates and hold a stick in his hands is not too young to begin to learn the game. True, he has a long, hard road ahead before he will reach the top. My knowledge of hundreds of top-notchers leads me to believe that a player has five or six years when he is at his peak—when his physical and mental co-ordination functions most perfectly, and when he can put on added steam at a call for a "power play." Those years are apt to be from the ages of twenty-four to thirty. There are exceptions. Helge Bostrum, formerly with the Hawks, was about thirty-nine when he hung up his stick.

A piece of elm, the handle and shaft of which are fifty-three inches long, with a blade fourteen and three-fourths inches long, turning off at an angle from the shaft—that is the stick. The beginner must learn first that hockey rules forbid carrying or holding the stick higher than his shoulder. He must absorb the knack of carrying the rubber puck—when he has it—on the blade of the stick, and of knowing its position on the blade without looking at it. He will need his eyes for other things, to watch the movements of his opponents and of his teammates, for he must guard against body checks from the former, or

having the puck stolen by an opponent. Also, since hockey is a game of teamwork, he must watch for the opportunity to pass the puck to a teammate who may be in an advantageous position for a try at goal. Hockey is so kaleidoscopic that the picture never stands still.

A body check, which is a forceful bump, or shove, or joust, by one player ramming another with his shoulder and hip, from a crouching position, is used to make the other fellow lose the puck off his stick, or to deflect him in the course he is skating. There is no use pretending it is gentle. Professional rules forbid a player who is standing still from taking more



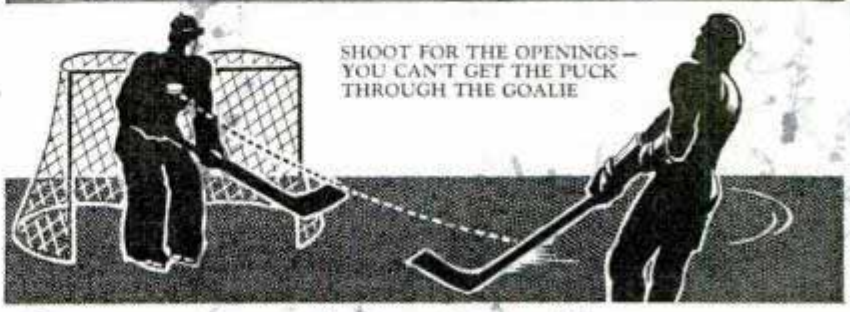


Top, tense moment in Black Hawks-New York Rangers game. Arrow points to puck flying through the air. Below, "Doc" Romnes hurdling sticks of two other players in chase for puck. Sketch (above) gives tip on how to skate. Bottom of page, good advice on shooting

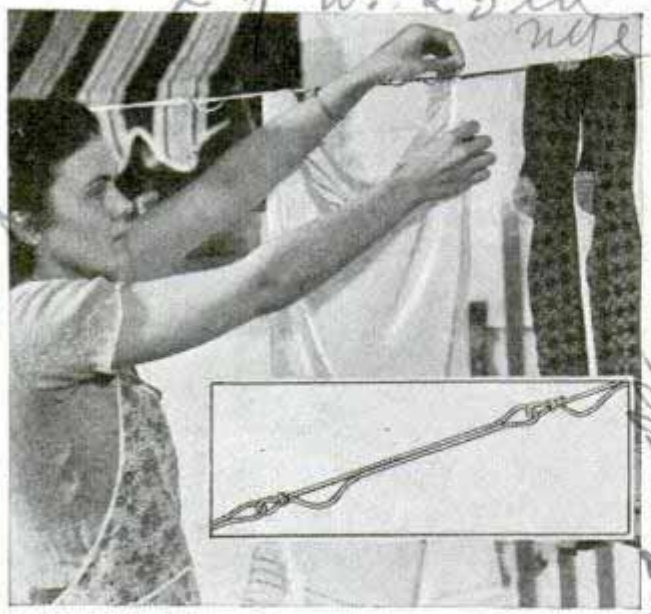
than two strides before giving such a check. However, if he is skating he may check right into the other fellow, when it's a case of winner-take-all. A shoulder-and-hip check is faster than a full body check, for in giving it you are less apt to lose your own balance.

Body checks demand physical stamina, so one of the professional training stunts is for members of the team to lunge forcibly at each other, arm to arm and shoulder to

(Continued to page 143A)



Pinless Clothesline Pinches Wash in Wire Loops



Garments are hung on pinless clothesline by inserting them in loops which can be seen clearly in inset

Hanging the week's wash is simplified by a clothesline that eliminates the use of clothespins. Garments are inserted within wire loops, being slipped on and off easily; and the line has held from 600 to 700 pounds in breakage tests. The heaviest fabrics—even blankets and carpets—or the sheerest silk apparel are gripped securely.

Captive Ball for Golfing Practice Indicates Quality of Stroke

Golfers can practice indoors wherever there is room to swing a club if they use a captive ball attached to a rubber mat, now available. An elastic cable pulls the ball back to the "tee" after it has been struck, and the direction in which it flies indicates whether the drive was "down the fairway," a hook, or a slice. Noting how far the ball travels gives an idea of the relative distance of various drives. The ball is made of soft rubber and will not damage furniture nor break windows if it becomes detached.

Golf mat for indoor practice pulls ball onto "tee," as above, by means of stout elastic shown at bottom

Folding Fire-Escape Ladder Attached to Any Window

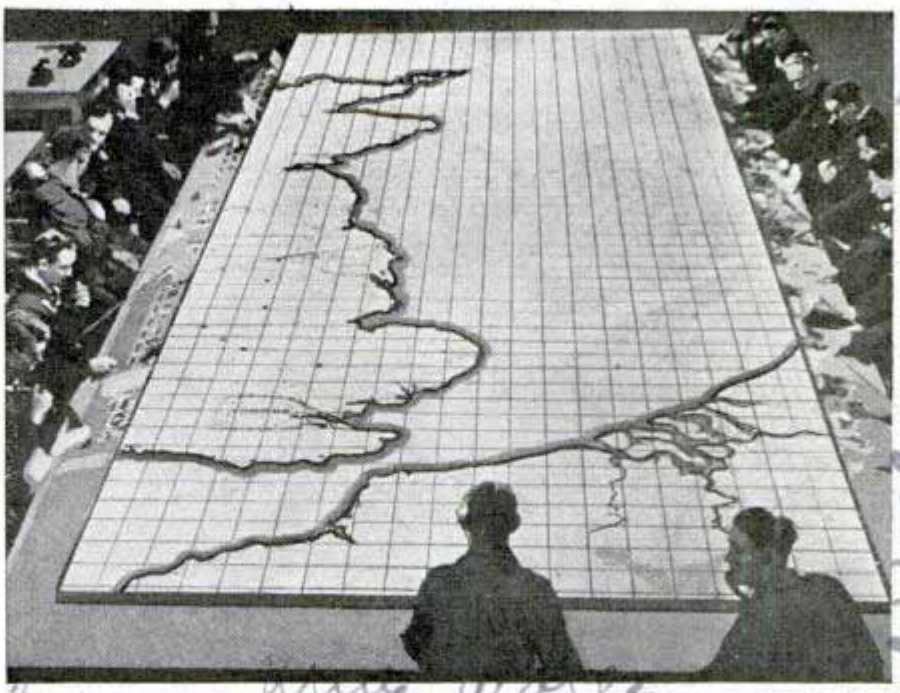
Always ready for use in case of fire, an emergency fire-escape ladder remains folded, accordion-like, when stored. In thirty seconds the collapsed ladder can be attached to a window and lowered to the ground for a safe means of exit. A bar that can be extended at both ends straddles the window frame and holds the ladder by two connecting chains. The sides consist of a series of steel plates overlapping where they are screwed into the hard maple rungs. The unit has a tensile strength of 1,000 pounds.

Lowering folding ladder from window provides safe means of escape from burning building

[Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

Huge Table Map Is Key to Air-Raid Defense

Key to the defense of the English coast against air raids is a vast table map around which members of the defense staff sit in constant watch. At the first signal of approaching planes, their position is plotted on the chart, the staff keeping in telephonic communication with lookouts all along the coast. In turn, they relay information to artillery, air-force and air-raid precaution staffs.



Operators seated around table map of English coast plot course of approaching enemy planes

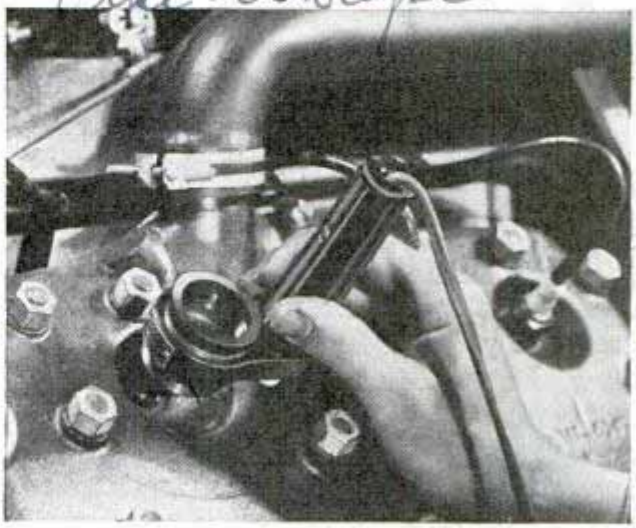
Tractor Fighting Fires in Hills Carries Its Own Water

To battle fires in the rough hill country surrounding the city, the Los Angeles fire department has a tractor that carries its own water. With a tractor, the firemen can get to the scene of the blaze miles from paved roads, and its 1,000-gallon tank renders it independent of city water supplies.

Fire engine carrying own water tanks can quit road and travel over rough country on its treads

Magnifier Shines Its Spotlight to Show Up Defects inside Engine

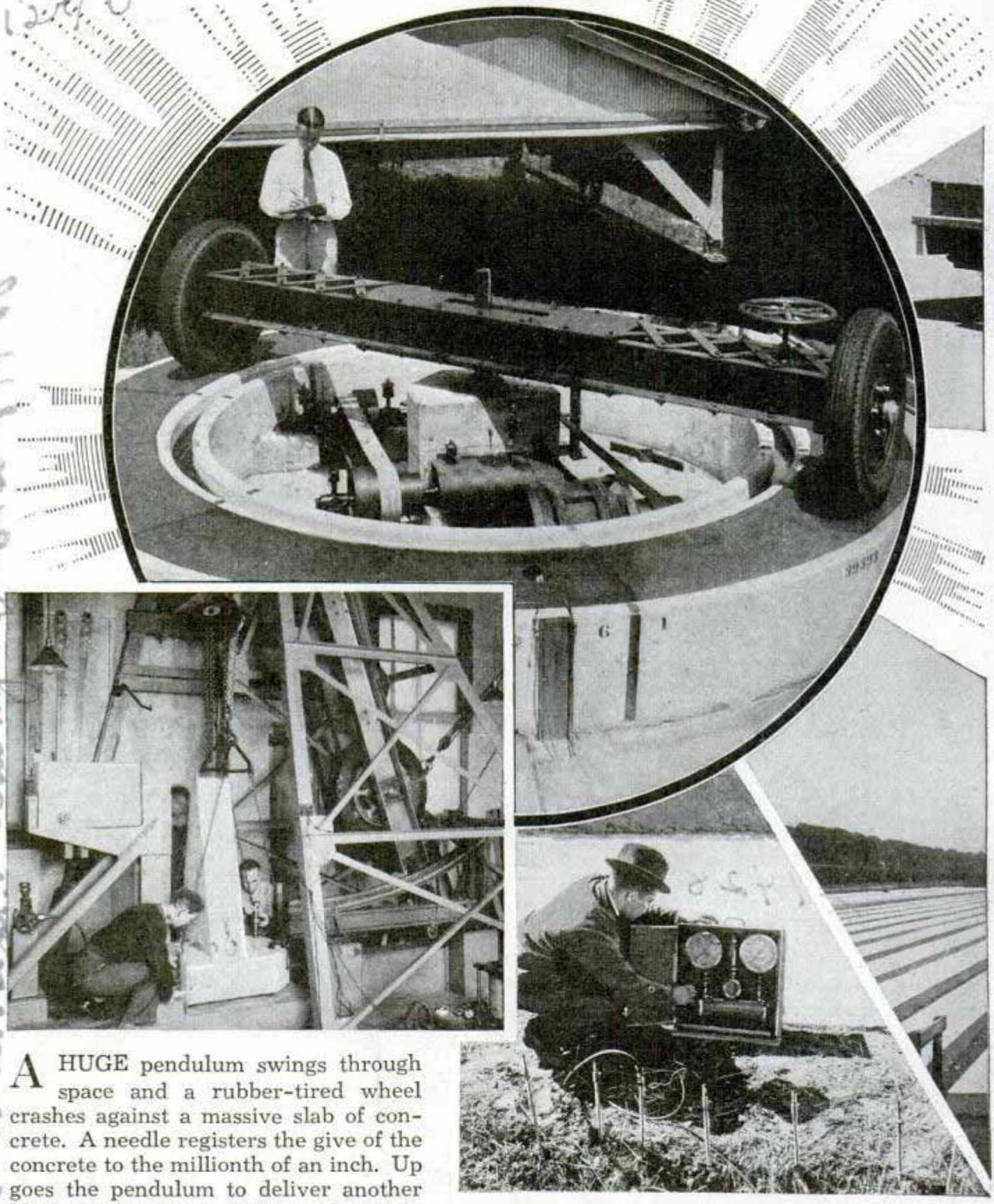
Inside surfaces of valves and valve seats are seen clearly for close inspection with an illuminated magnifier which may be attached to any electric outlet or equipped with dry-cell batteries. Defects are spotted readily even at a distance of two feet from the eye. Light comes from a special lamp built into the bottom of a cylinder which also serves as a handle. The lamp cylinder and the threaded ring for the lenses are made of shock-resistant Bakelite.



Light shines on part as user peers through magnifier

¶World production of coffee amounts to five billion pounds a year, and 1,700,000,000 pounds, or thirty-four per cent of it, is consumed in the United States.

TESTING *the* ROADS



A HUGE pendulum swings through space and a rubber-tired wheel crashes against a massive slab of concrete. A needle registers the give of the concrete to the millionth of an inch. Up goes the pendulum to deliver another blow. Impact force of the tire has been calculated carefully and the thickness and ingredients of the concrete have been recorded. Presently the pendulum will break the slab. And man will have one more fact to help build better roads.

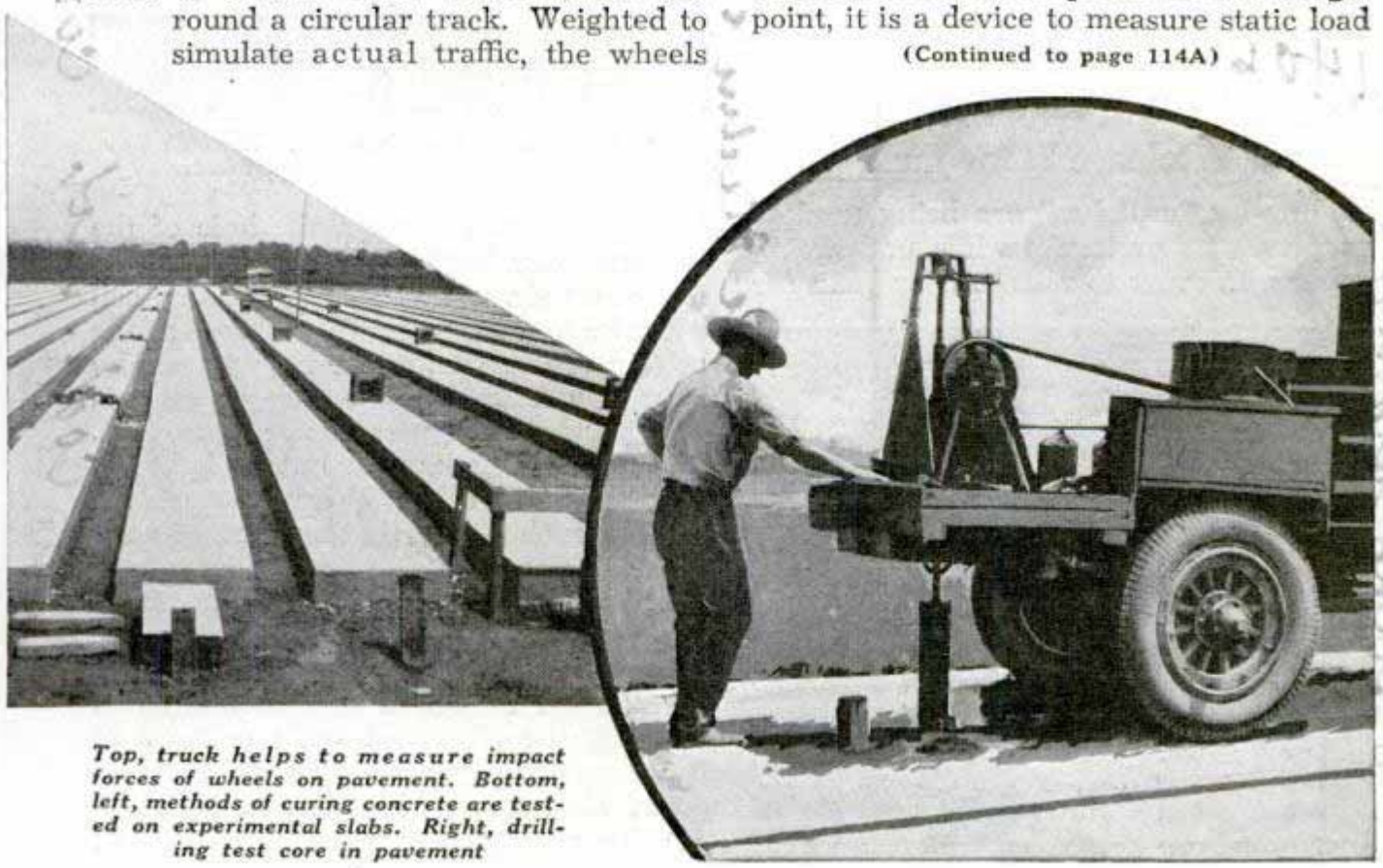
Outdoor circular track used in making weathering tests on bituminous pavement at the Arlington, Virginia, experimental farm of the Public Roads Administration; pendulum machine measures resistance of concrete to repeated blows of wheel (left), and soil-pressure cell for measuring pressure of pavement upon soil beneath

of the FUTURE

At their laboratories and testing grounds near Washington, D. C., scientists of the U. S. Public Roads Administration, by mechanized torture, are determining the life and properties of all manner of road materials. Telescoping time and distance, manufacturing synthetic traffic and weather, the technical experts test roads years sooner than it could be done by trial and error, and produce formulas to improve super-highways and simple country roads. Two automobile wheels mounted at the ends of a steel beam travel round and round a circular track. Weighted to simulate actual traffic, the wheels test an experimental pavement which contains varying amounts of cement at different points. The wheels roll on day after day, and some sections of the little road remain hard and firm, others get soft and spongy. As years of traffic wear are condensed to weeks or months, the road life of each mixture becomes a known quantity.

Beside the Potomac, a large water tank is mounted on rails above a road. Poised to focus tremendous pressure on a single point, it is a device to measure static load

(Continued to page 114A)



Top, truck helps to measure impact forces of wheels on pavement. Bottom, left, methods of curing concrete are tested on experimental slabs. Right, drilling test core in pavement

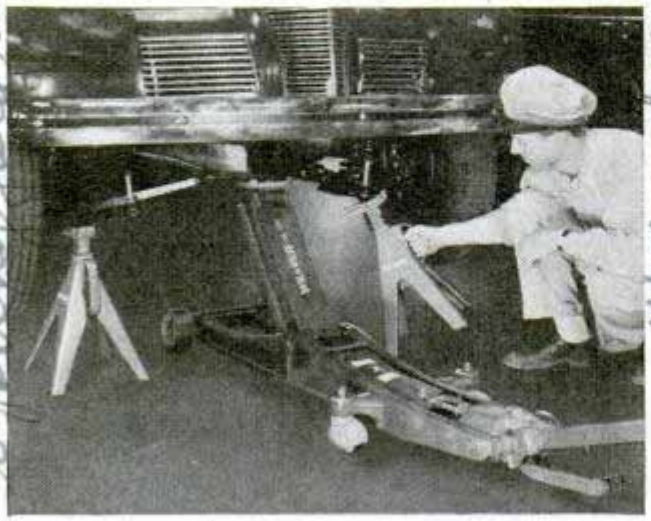
Self-Locking Electric Plug Cannot Pull Out

Pulling cord will not dislodge plug because tabs on prongs shown in inset, upper right, lock it in place

Electric cords will not pull apart if they are fitted with a twist-lock plug and socket which can be separated only by giving them a reverse twist to unlock the prongs. Tabs at right angles project at the end of the prongs and take hold inside the socket when the plug is inserted and twisted.

"Crutches" Support Raised Car to Release Floor Jack

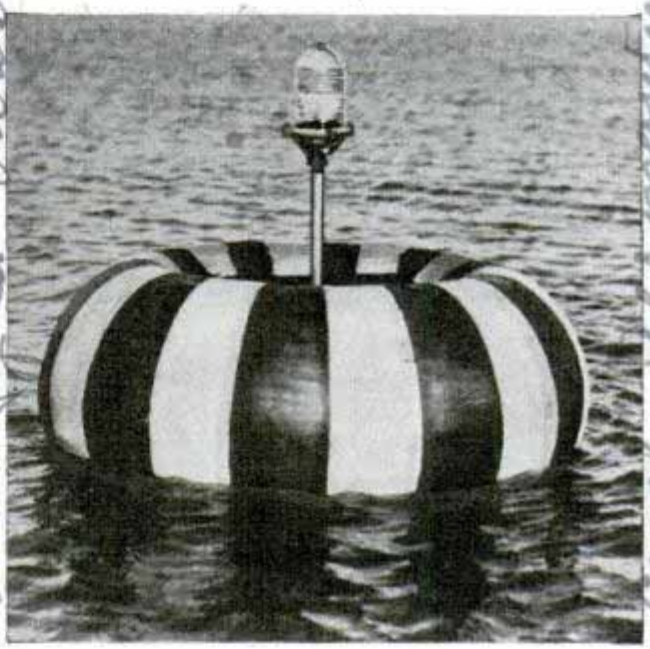
Four-leg "crutches" are being used to prop up cars or trucks while undergoing repairs, in order to release floor jacks for service on other jobs. Being adjustable in height from fifteen and one-quarter to twenty-two inches, the auto prop safely holds two tons. It has a convenient handle for placement under cars.



Adjustable props support car after it is jacked up

Marker Lights for Seadrome Permit Night Landings

Night landings of seaplanes may be made possible by a newly developed seadrome marker light. Already accepted by the navy, the new light looks stationary even though it is tossing on a wave-swept sea. The light, made of rubber and shaped like a doughnut with a lamp extending upward at the center, weighs about 185 pounds. A thin pipe passes through the hole of the four-foot doughnut, with the light on top, three feet above water level, and dry-cell batteries in a waterproof metal case at the bottom of the pipe, under the water. The light is a fluorescent or gaseous electric bulb enclosed in a prismatic or fresno lens. The covering lens is clear but the light ray is greenish in color. Prisms deflect the light in such a way that an area of solid glow is created. Inside this area the light actually may move back and forth without the movement being perceivable to the distant observer. When a plane comes down, even though a four-foot swell is running, the pilot will see two rows of lights apparently as stationary as lamp posts. He thus gets his perspective without shimmying illumination on the water.



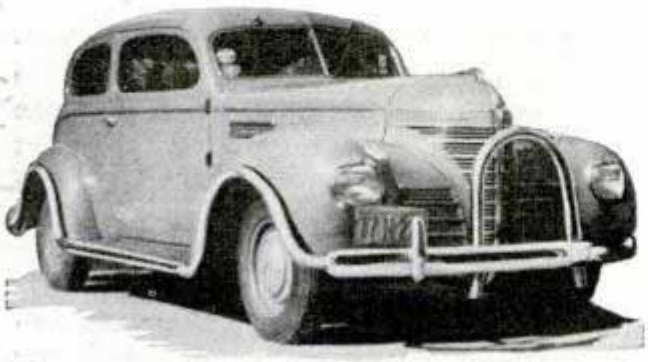
Closeup of new seadrome marker light which may make possible night landings on water

Magnetic Speedway for Atoms Analyzes Gases

On a magnetic speedway, called a mass spectrometer, atoms racing at 1,000,000 miles an hour are sorted at the end of the course according to their mass, or relative weight, as a part of the research conducted at Westinghouse laboratories to obtain information concerning the breaking up of gases which will be helpful in the manufacture of fluorescent lamps. The race track is a semicircular vacuum tube twenty inches long, resting inside a hollow ball divided in two halves and wound about by 7,000 feet of quarter-inch copper tubing. When electric power is applied to the copper ball it becomes an electromagnet strong enough to pull some of the atoms off their course. Vapor to be tested is placed in a chamber of the copper ball where its atoms are ionized by bombarding them with electrons. By means of an electric voltage, these ions are pulled into the curved tube through a slit at speeds faster than 16,000 miles a minute. Because of the effect of the magnetic field, only the heavier ions follow a straight course and reach the opposite end of the vacuum tube, where they leave through another slit. It is possible, by changing the voltage at the starting end, to bend the courses of all the various ions and eventually to usher them all through the exit slit. With a galvanometer the electric currents of the various streams of ions are amplified and measured, thus indicating the relative amounts of different ions coming from different substances.

Assembling vacuum tube of new spherical mass spectrometer, designed to sort atoms and molecules in search for facts about breaking up of gases

All-Around Bumper Guards Against Accident Damage



This car is protected all around by strong steel tubing fitted along edges of fenders and running board

To prevent or reduce damage that might result from a collision a Los Angeles physician designed, and installed on his car, a shock fender of strong steel tubing. The tubing forms a continuous line of armor, skirting along edges of the fenders, running boards and front and rear bumpers, and affords protection against damage caused by side bumps. Once when the physician's car was forced into a ditch the only damage was a few minor scratches.

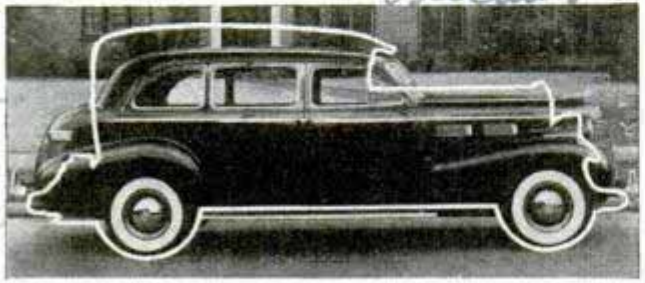
Lights at Back of Motorcycle Lead Bus through Fog

Fitting special light that bus driver may see but is invisible to enemy air raiders at night

Special signal lights, designed to meet "blackout" regulations, are fitted to the rear of motorcycles which run ahead of buses in Manchester, England, to guide them in foggy weather. Night blackout has made fog driving extremely difficult, and the motorcycle convoys help speed up transportation and reduce accidents.

Outline of Old Car over New Shows Advance in Comfort

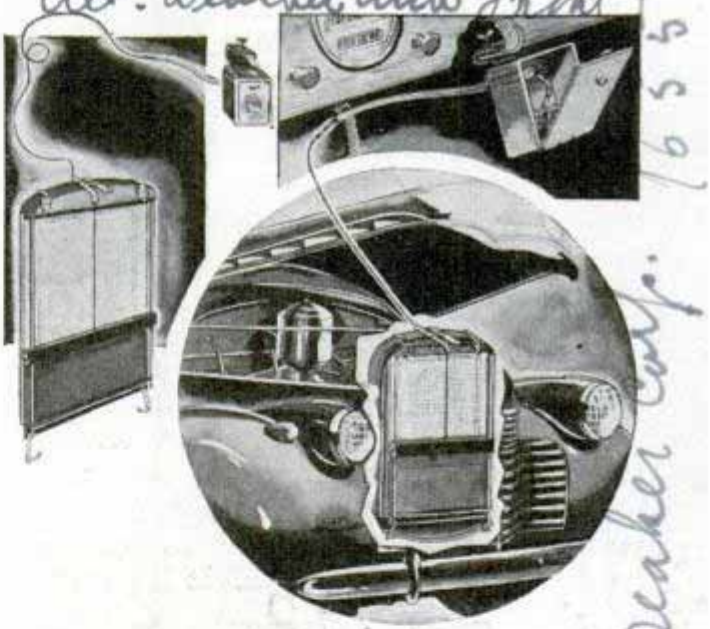
How roomier seats and more riding comfort have been designed into automobiles without increasing the wheelbase, is illustrated by outlining the contour of a 1930 body over the photograph of a 1940 model. Both models are Cadillacs and each is mounted on a 138-inch wheelbase. Ten years ago passengers in rear seats rode directly over the rear axle, while today rear seats are well ahead of the axle. Mounting the front axle behind its former position beneath the radiator has increased the interior length by sixteen and three-fourths inches, and locating the motor further forward has meant added leg room. The 1940 car roof is several inches lower than the model of 1930, and lower floors have been made possible by hypoid rear axles. Front seats have been widened fifteen inches, and the rear seats about three inches. Both front and rear doors are five inches wider than formerly.



Lines of 1930 model sketched over photograph of new car show how changes in design add to comfort

Bug Screen and Radiator Front Works Like Roller Shade

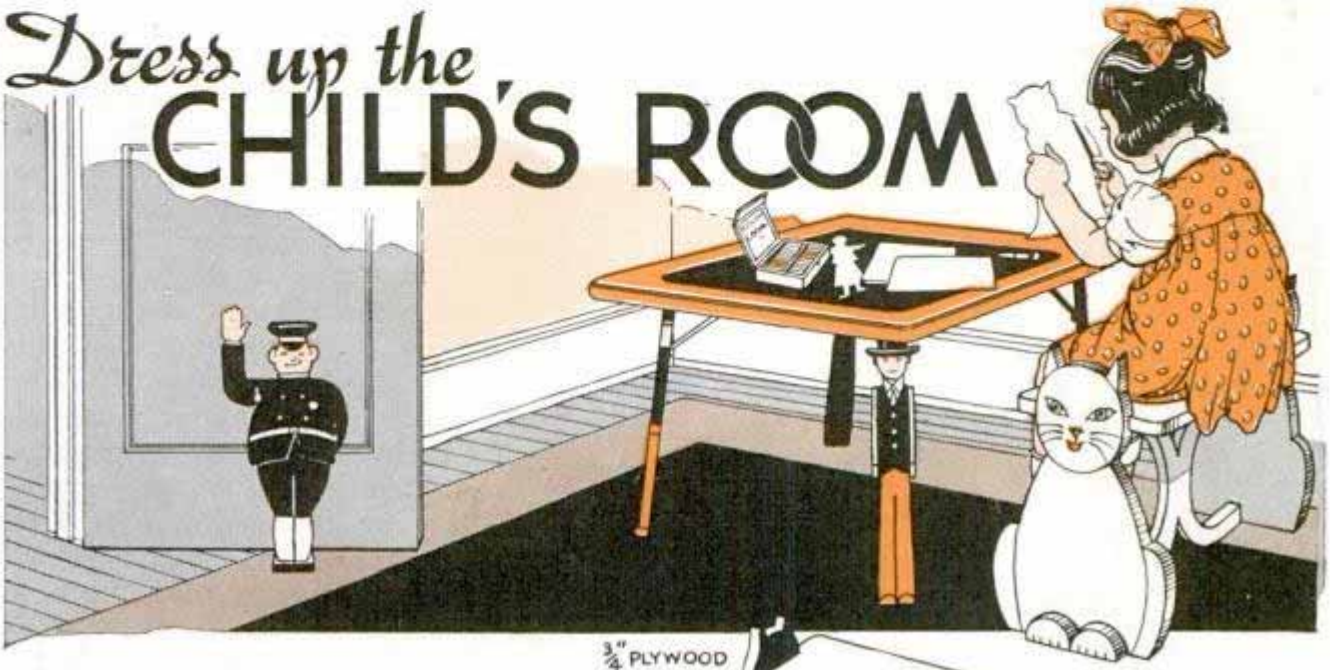
Year-round service is offered by a combination bug screen and adjustable winter front for the car which is installed out of sight between the grillwork and the radiator. In cold weather a spring roller curtain, made of waterproof fabric, covers the radiator to any desired degree. It is operated from the driver's seat and can be locked in any position. When not in use the control device is housed in a small box under the instrument panel. During summer months a single pull of the control sweeps bugs from the built-in screen.



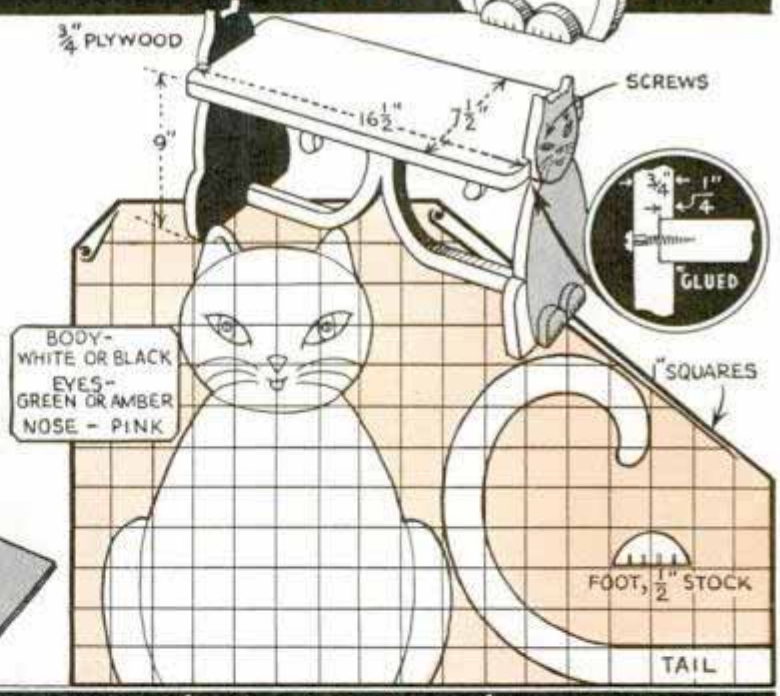
Left, winter front operated by driver works like roller shade. Right, sketch shows installation in car

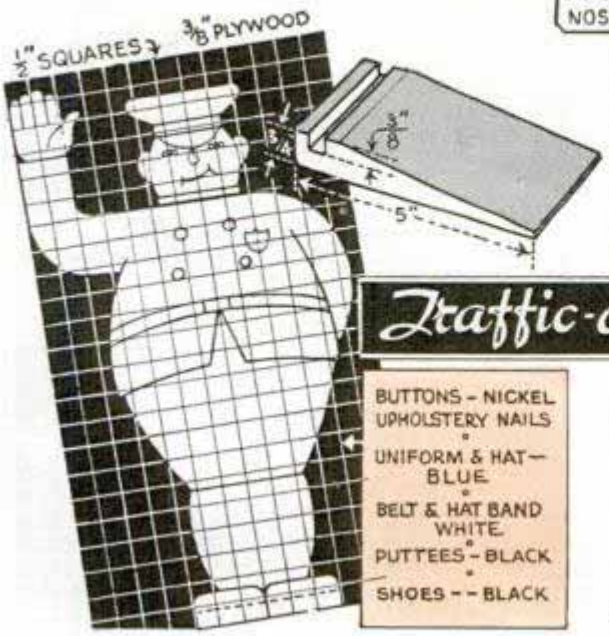
¶Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

Dress up the CHILD'S ROOM



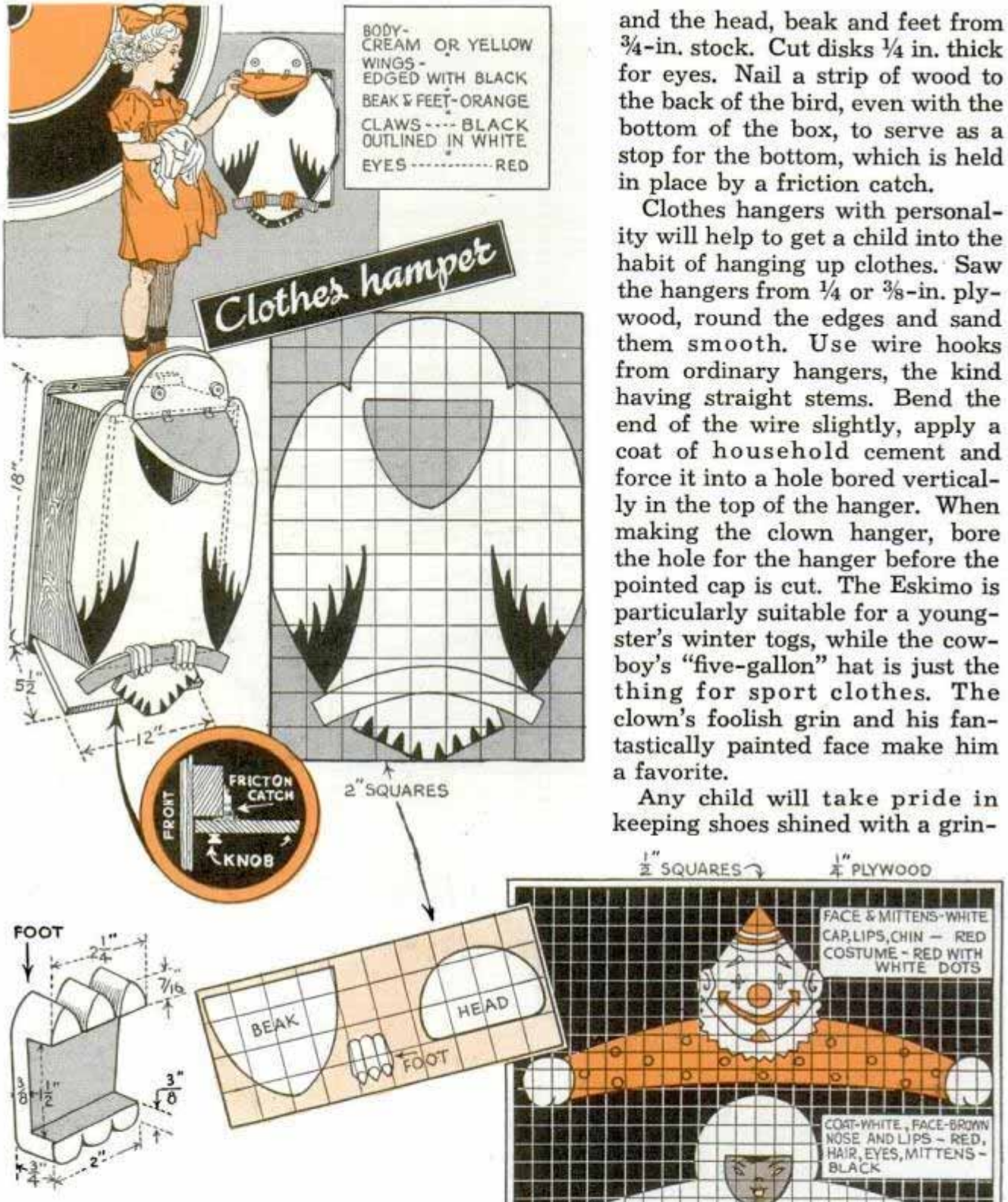
A ROOM in which each article has special appeal to the youngster's imagination will make play of the dullest routine matters and help to form good habits. Any ordinary room can be dressed up to please your child, with only the aid of a jigsaw and a few hand tools. All of the articles shown here are of simple construction, just the kind of work for spare time, and scraps can be utilized in making some of them.





Traffic-cop doorstop and cat bench

The traffic-cop doorstop is sawed from plywood and has a wedge-shaped base. It is grooved for the feet, which are glued and nailed in place. The buttons are small upholstery



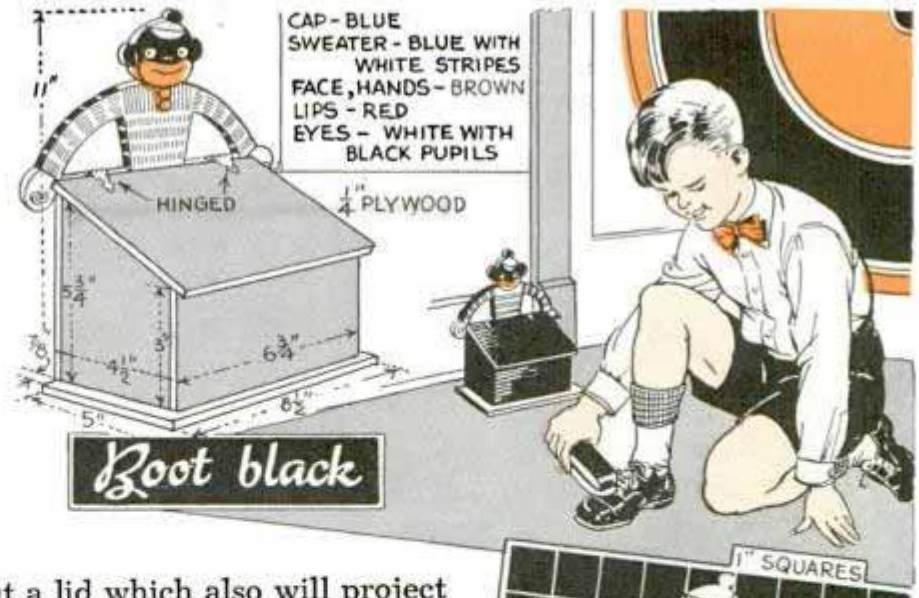
nails. The top of the cat bench fits into grooves in the sides, and screws are driven through the eyes into it. Round the corners of the top to meet the ends. The tails are attached with screws, which are countersunk, while the feet are glued and nailed on.

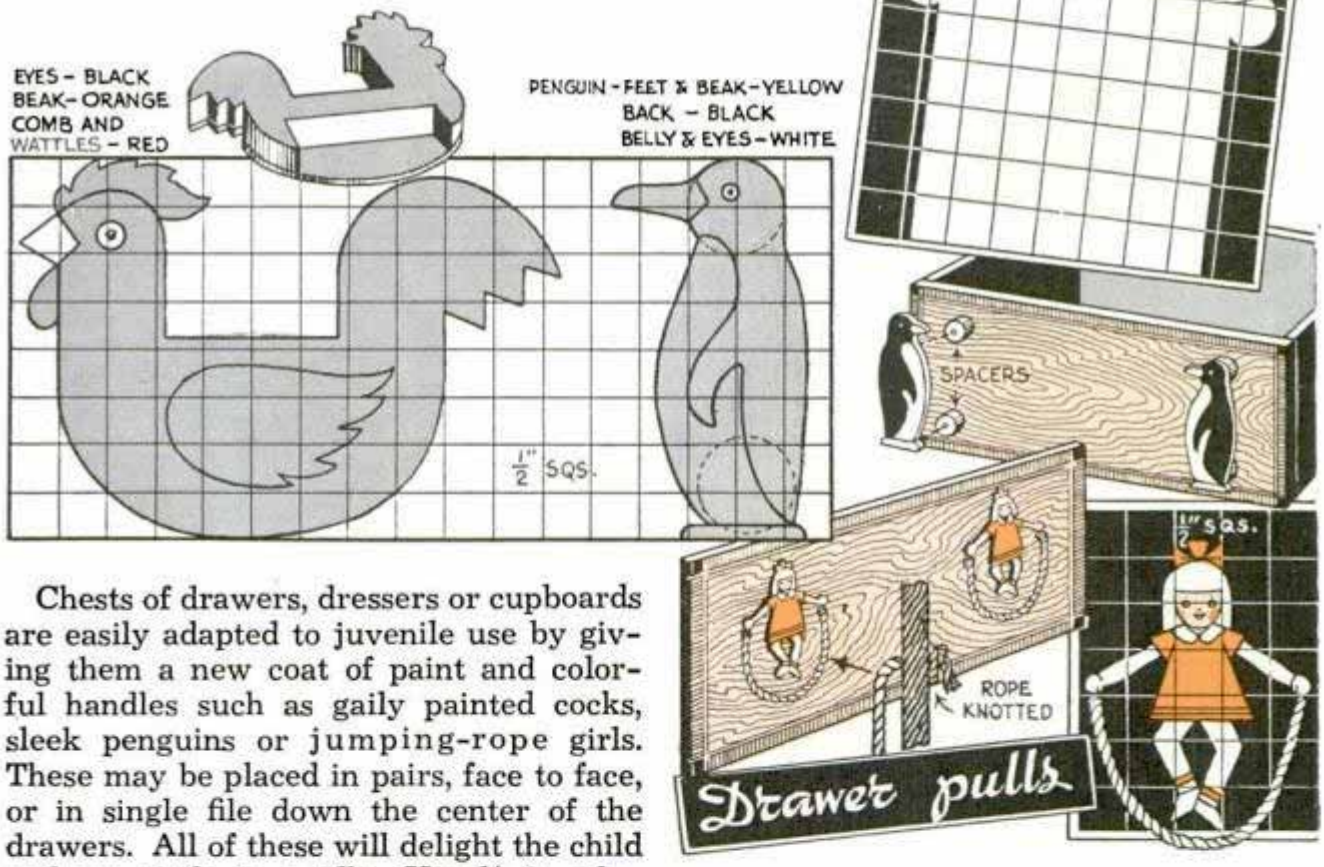
Putting soiled clothes into the bird-front hamper on the wall or door is a delight to any youngster. The hinged beak covers the opening and the bottom is hinged for removal of the clothes. Saw the bird from ¼-in., the limb from ⅜-in., and the head, beak and feet from ¾-in. stock. Cut disks ¼ in. thick for eyes. Nail a strip of wood to the back of the bird, even with the bottom of the box, to serve as a stop for the bottom, which is held in place by a friction catch.

Clothes hangers with personality will help to get a child into the habit of hanging up clothes. Saw the hangers from ¼ or ⅜-in. plywood, round the edges and sand them smooth. Use wire hooks from ordinary hangers, the kind having straight stems. Bend the end of the wire slightly, apply a coat of household cement and force it into a hole bored vertically in the top of the hanger. When making the clown hanger, bore the hole for the hanger before the pointed cap is cut. The Eskimo is particularly suitable for a youngster's winter togs, while the cowboy's "five-gallon" hat is just the thing for sport clothes. The clown's foolish grin and his fantastically painted face make him a favorite.

Any child will take pride in keeping shoes shined with a grin-

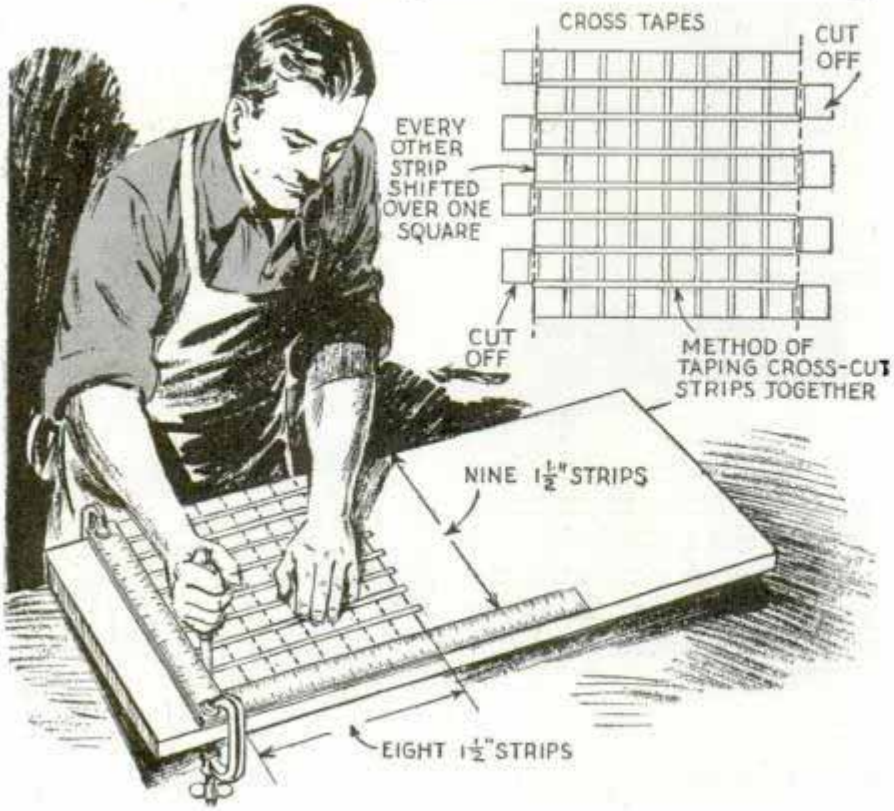
ning bootblack always ready to help. A little black box with the hinged top holds polishes and the darky's hands are provided with hooks to hold a shiner, buttonhook and shoehorn. Build the bootblack and box from ¼-in. plywood, sawing the back of the box and the figure in one piece. The base should extend beyond the sides and front of box and a notch is cut out for the back to fit in. Fasten the pieces together and saw out a lid which also will project a little over the sides and front. Black is the most practical color for the box, as it is just the right height to support the foot while shining the shoe. A vivid sweater and cap offer contrast to the black face and box. The eyes are white thumbtacks with black spots painted on them.





Chests of drawers, dressers or cupboards are easily adapted to juvenile use by giving them a new coat of paint and colorful handles such as gaily painted cocks, sleek penguins or jumping-rope girls. These may be placed in pairs, face to face, or in single file down the center of the drawers. All of these will delight the child and are made in a jiffy. Use ¼-in. plywood for the front of the cock and ¾-in. stock for the back, part of which is cut away to leave space for the hand. Glue the two pieces together and put in small screws at both ends to hold them more securely, countersinking them and filling the holes with putty or other plastic filler. Saw the penguins from ⅜-in. plywood. Glue and screw ¾-in. lengths of 1-in. dowel under each end to hold them away from the drawer to accommodate the hand. A small upholstery tack or a flat bead held on with a brad makes a good eye. The jumping-rope girls are cut from ¼-in. plywood, painted in gay colors and glued to the drawer. Lightweight, twisted clothesline is used for the jumping rope. Bore holes in the drawers behind the hands, draw the two ends of the rope through and tie knots on the inside to secure them.

Carpenters' Square Guides Knife When Cutting Thin Veneer Strips



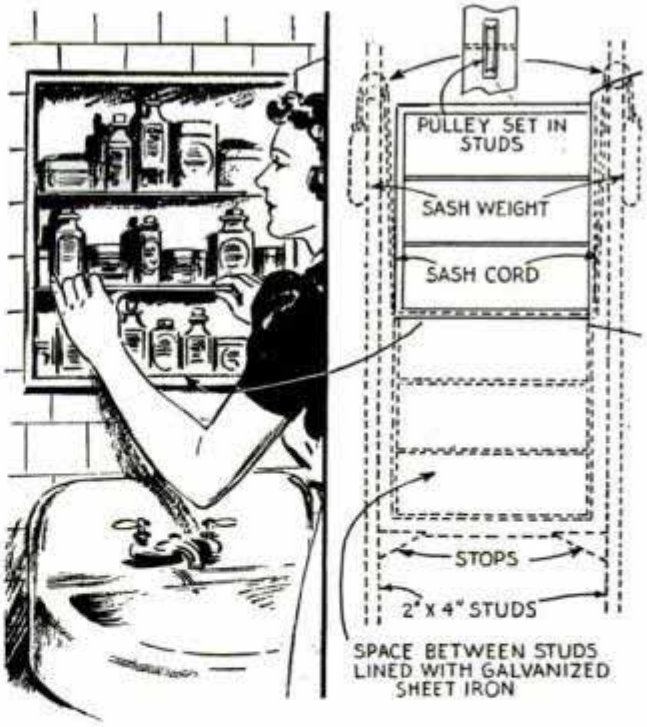
When a number of veneer strips 1½ in. wide had to be cut, the short side of a carpenters' square was found to be just the right width to serve as a knife guide. The square was clamped over the veneer and the knife was drawn along each edge, cutting strips with true edges that fitted together perfectly when taping the alternate colored strips together to form "checkerboard" sheets for gluing.

Corrections on Typed Sheet Made with Aid of Tissue Paper

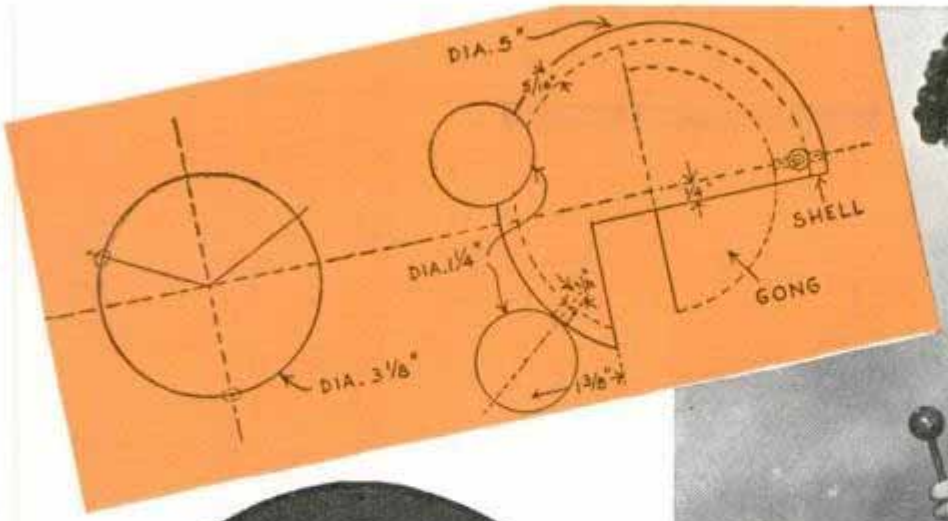
Should you have to make corrections on a typewritten sheet that has been removed from the machine, you can do a neat job of registering the correction if you use a strip of tissue or other semi-transparent paper. After erasing the words where the correction is to be made, replace the work in the typewriter and adjust it for the correction as close as possible. Then slip the strip of tissue paper between the sheet and the ribbon, and type the correction on it. The typing on the sheet will show through the tissue paper so that you can tell if the correction registers in exactly the proper position. If not, adjust the sheet and try again. When the register is correct, remove the tissue paper and type the correction on the sheet.—Blair L. Gilbert, Chicago.

Bathroom Cabinet Is Hung Like Window Between Studs

Desiring a bathroom cabinet having several shelves without making the hole in the wall larger to accommodate them, one home owner made sliding shelves similar to the ones shown. They are built into a unit and hung on cords so that they will slide up or down between the studs. The cords pass over pulleys set in the studs, and the shelves are counterweighted with sash weights. A door is provided over the opening in the wall to resemble the regular bathroom cabinet. In use, the shelves are moved up or down like a window sash to bring the article desired within reach.



Spherical Shell Houses Chrome Dinner Gong



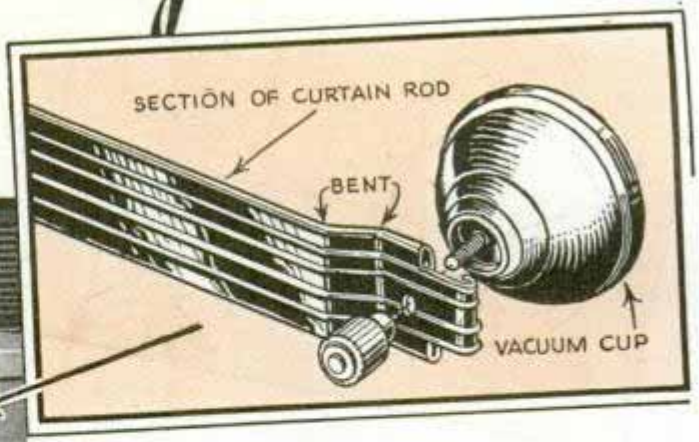
With chromium-plated balls for feet and a matching hemispherical bell inside of a brightly colored wooden shell, this dinner gong is an interesting job for any wood-turning fan. Glue together three pieces of 2-in. hardwood and mount the blank on the faceplate. A cardboard template is used to check the spherical shape. Turn carefully near the base so that only a small scar is left when the ball parts. Sanding is done at fair speed while the work is firmly attached. Cut out the notched front with a handsaw and then rout or drill out most of the inside. Next, turn a chuck into which the ball is forced, with the notch outward. Two or three screws in the chuck, bearing against the edges of the shell, will keep it in place if you take light cuts. Keep the hands away from the whirling edges. The feet are spaced equidistantly on a 3⅛-in. circle marked with a compass. Also turn a ball for the mallet and fit it with a ¼-in. dowel for a handle.

Clothespins Anchor Baby-Chick Pen Securely to Ground

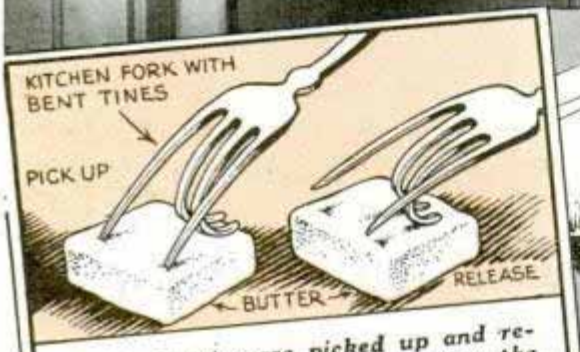
Amateur poultry raisers who have a few baby chicks each spring and keep them in small circular wire pens, will find that ordinary wooden clothespins provide good anchoring stakes for the pens. They straddle the lower wire of the pen, and are easily pushed into the ground, where they hold the pen against tipping or damage from dogs and other pets about the home. When the pen has to be moved to a clean spot every day or so, it takes only a moment to pull the pins and reset them.

If a pan is rinsed in cold water before heating milk in it the milk will be less likely to stick to it.

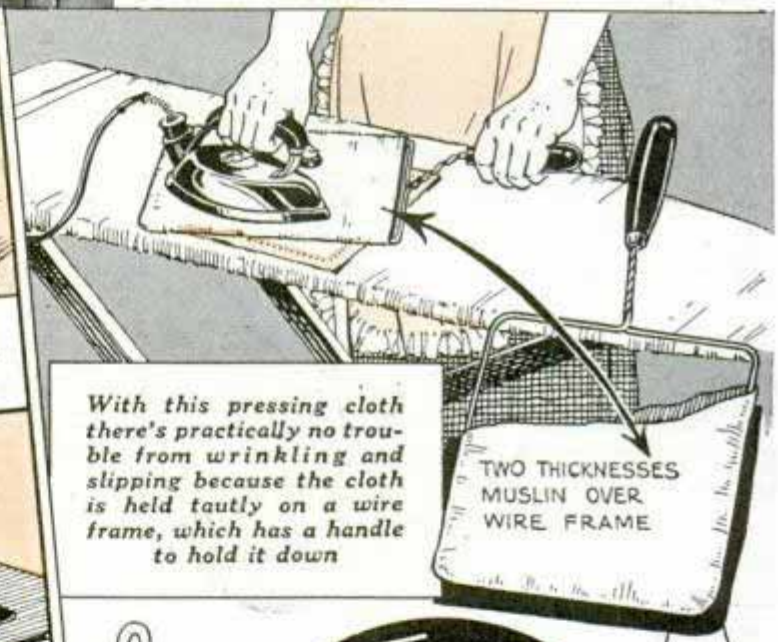
Solving HOME



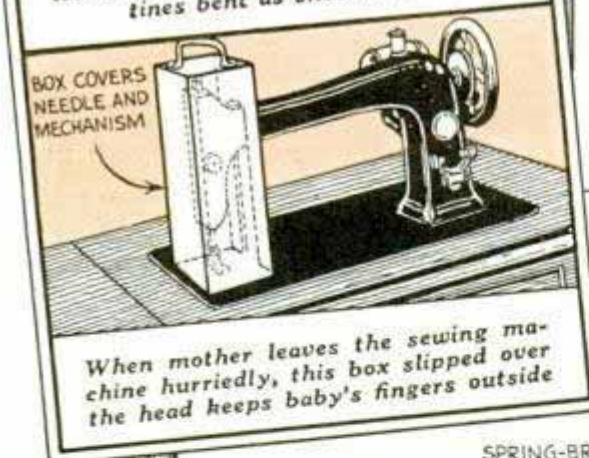
The end of a modern gas or electric stove is a handy place for a towel rack, which anyone can assemble from a length of flat curtain rod and two small vacuum cups. The cups will hold indefinitely if the edges are moistened with glycerin before pressing them against the stove



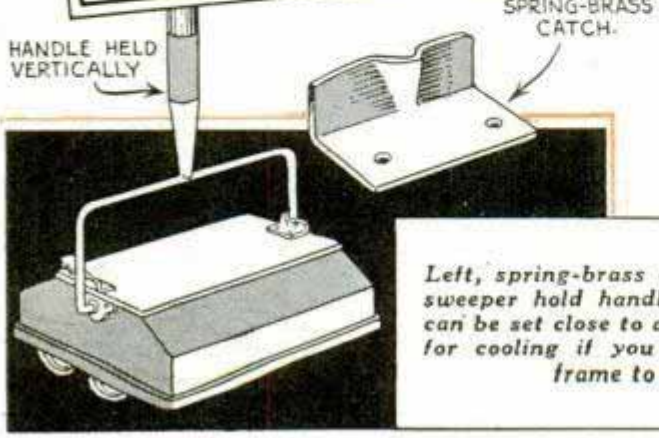
Butter patties are picked up and released easily with a fork having the tines bent as shown above

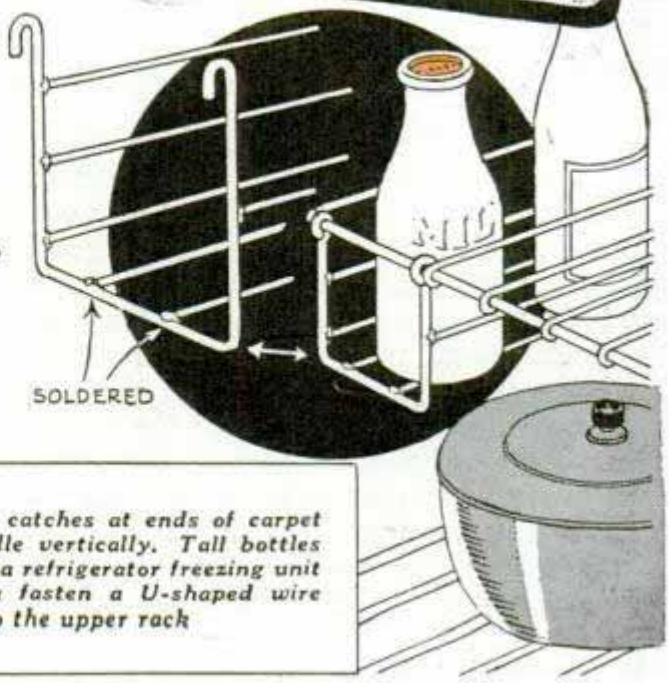


With this pressing cloth there's practically no trouble from wrinkling and slipping because the cloth is held tautly on a wire frame, which has a handle to hold it down



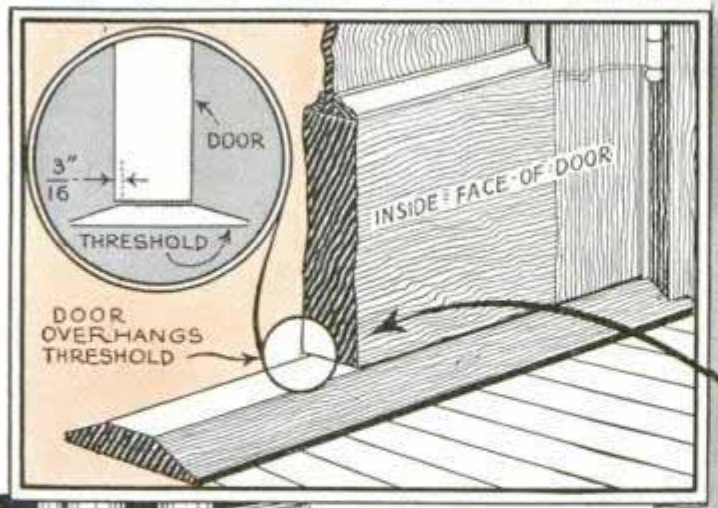
When mother leaves the sewing machine hurriedly, this box slipped over the head keeps baby's fingers outside



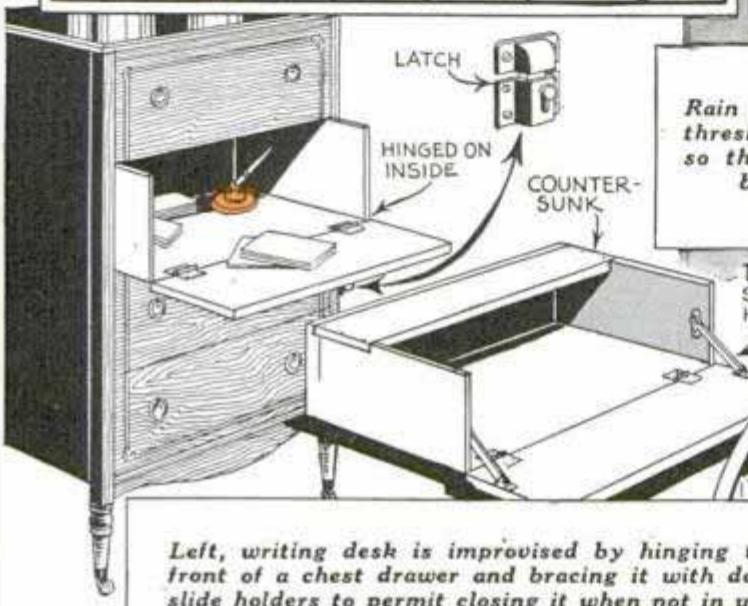


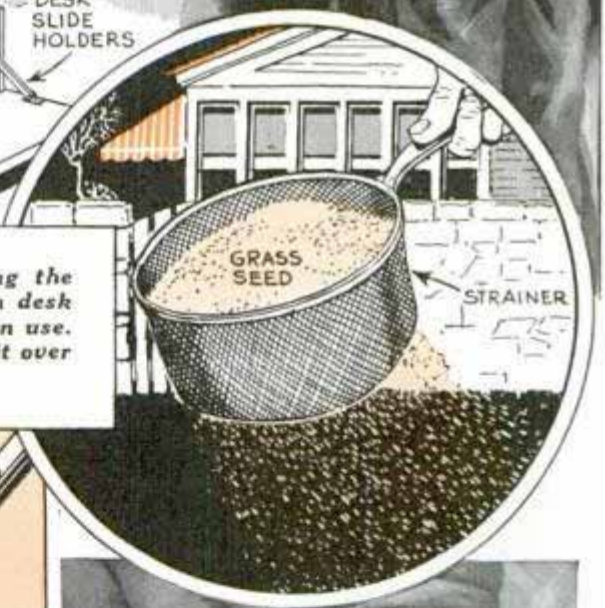
Left, spring-brass catches at ends of carpet sweeper hold handle vertically. Tall bottles can be set close to a refrigerator freezing unit for cooling if you fasten a U-shaped wire frame to the upper rack

PROBLEMS

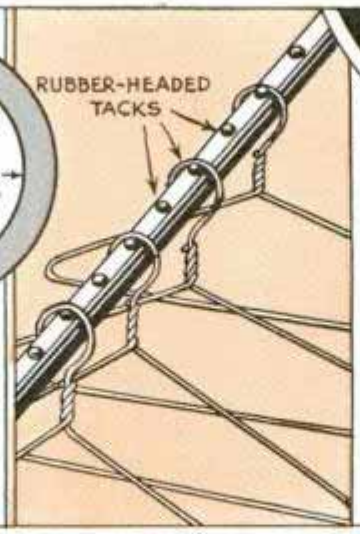


Rain is not likely to creep between a threshold and a door if the latter is hung so that the outer face projects slightly beyond the top of the threshold





Left, writing desk is improvised by hinging the front of a chest drawer and bracing it with desk slide holders to permit closing it when not in use. Right, grass seed sown uniformly by sifting it over ground with a household strainer



Shellac-jar cover loosened easily when screwed down on a sheet-metal gasket shaped as at the left. Turning gasket by handle breaks dried shellac. Rubber-headed tacks in closet pole, above, prevent garments sliding together. Right, tool-handle wedge is just the thing for prying off lids of vacuum-sealed cans

Initials Burned in Tool Handles with Fingernail Polish

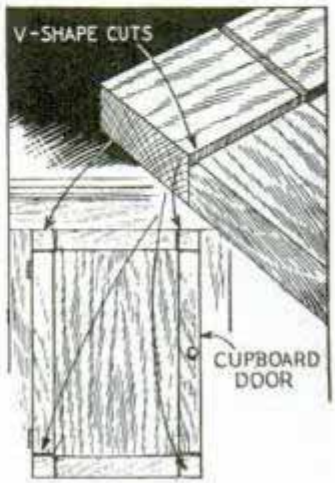
A good way to initial your wood tool handles is to use ordinary fingernail polish. Just make the initials on the handle with the polish and then ignite it. As the polish burns, it will char the wood under it. If you want the initials burned deeply into the wood, use two or three applications of polish, igniting it after each application.

Block Prints Easily Imitated

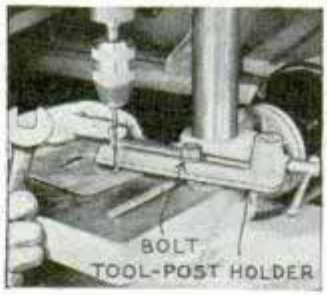
It is a simple matter to make imitation block prints such as the one shown. The materials needed are white tempera paint, India ink, a brush and running water. First sketch in the white parts of the picture with the tempera paint. When this has dried, paint over the entire surface with the ink. Let this dry and then hold the picture under running water, going over it lightly with a clean, soft brush. The ink will wash off only where there is tempera paint under it, leaving a reverse drawing.

V-Cuts Improve the Appearance of Door on Cupboard

To relieve the plainness on the face side of a light, paneled, cupboard door, one carpenter cut shallow V-grooves across the surface at each corner of the door. The grooves were cut at right angles and in line with the joint and edge of the stile.



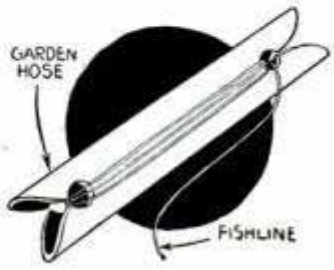
Work Clamped on Drill Press by Lathe Tool-Post Holder



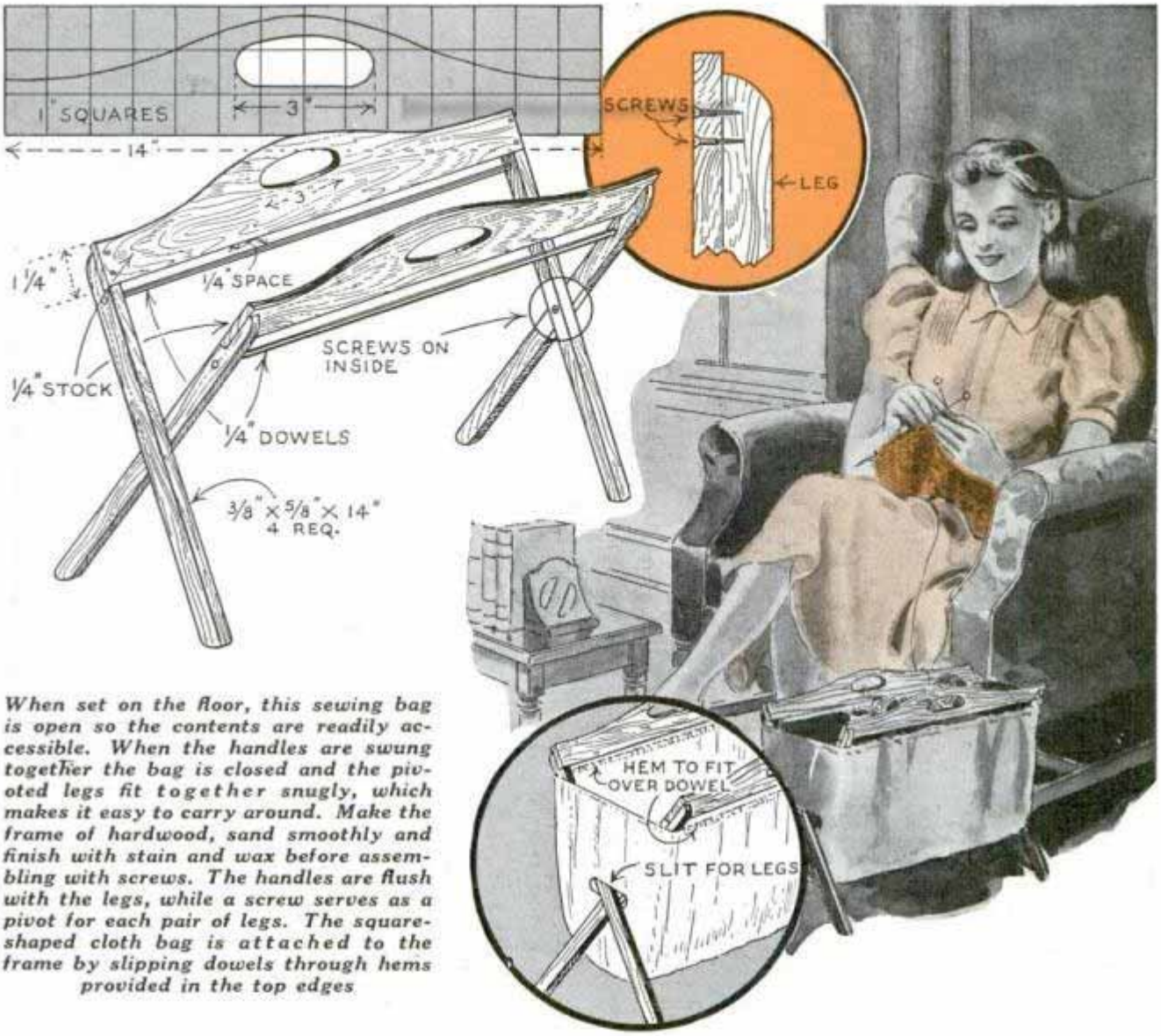
The tool-post holder of your wood-turning lathe will be found handy for clamping work to the table of a drill press. A bolt passing through the table slot and the holder clamps the assembly in place. To level the clamp with the work, a piece of wood the same thickness should be placed under the clamp.

Non-Tangling Fishline Reel

This reel will keep fishline from tangling, yet allow the line to be wound or unwound easily. The reel is made from a piece of rubber garden hose with a notch cut in each end as indicated in the drawing.

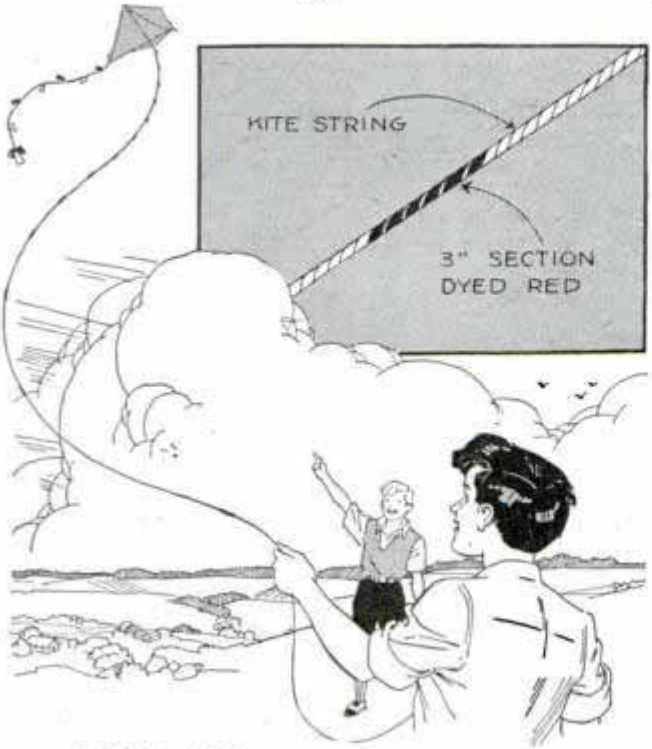


Portable Sewing Bag Stands on the Floor



When set on the floor, this sewing bag is open so the contents are readily accessible. When the handles are swung together the bag is closed and the pivoted legs fit together snugly, which makes it easy to carry around. Make the frame of hardwood, sand smoothly and finish with stain and wax before assembling with screws. The handles are flush with the legs, while a screw serves as a pivot for each pair of legs. The square-shaped cloth bag is attached to the frame by slipping dowels through hems provided in the top edges

Scale Markings on Kite String Aid in Measuring Distance



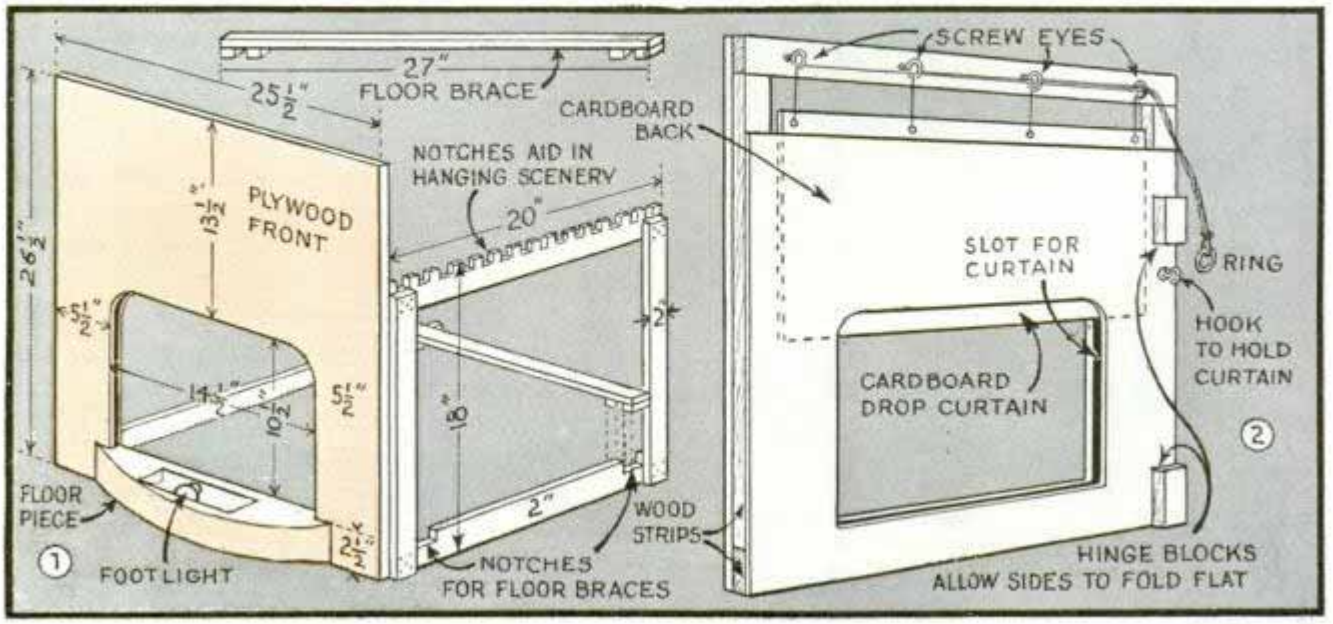
When a group of boys are flying kites in neighborhood competition meets to see who can pay out the most string and fly the greatest distance, it will help to mark the string with red ink at intervals of 25, 50 or 100 ft. This is much better than the usual method of tying small ribbons to the string to serve as markers. Red is also highly visible and the marks can be seen for quite a distance, although the marks can be counted as the string is let out.

¶If you have an idea that might be used for a short article in these pages, send it to the Homecraft Editor. Inclose a snapshot or drawing and give all the necessary information in as few words as possible. To be accepted, material must be of general interest and different from any we have published previously.

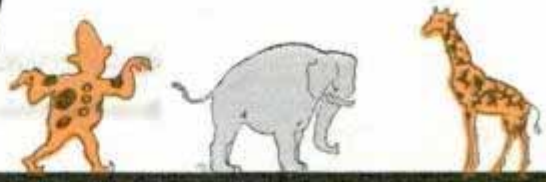
By LESTER LEHNHERR

THIN crating stock obtained from a furniture store, a few pieces of plywood and corrugated cardboard are all the materials needed to build this folding table-top theater. Not too difficult for young people to make, the stage will provide many hours of busy activity in making and rearranging the scenery, and "playing show." Those photo amateurs interested in table-top photography will find the stage useful in their hobby. The frame will greatly facilitate arranging the lights, settings, and props used in this form of miniature photography. If to be used only for photographic purposes, the stage opening in the front can be made larger than that indicated in the dimensioned details.

The theater consists of a front or proscenium piece with two frames from which to hang the scenery hinged to the back of



Show's on!

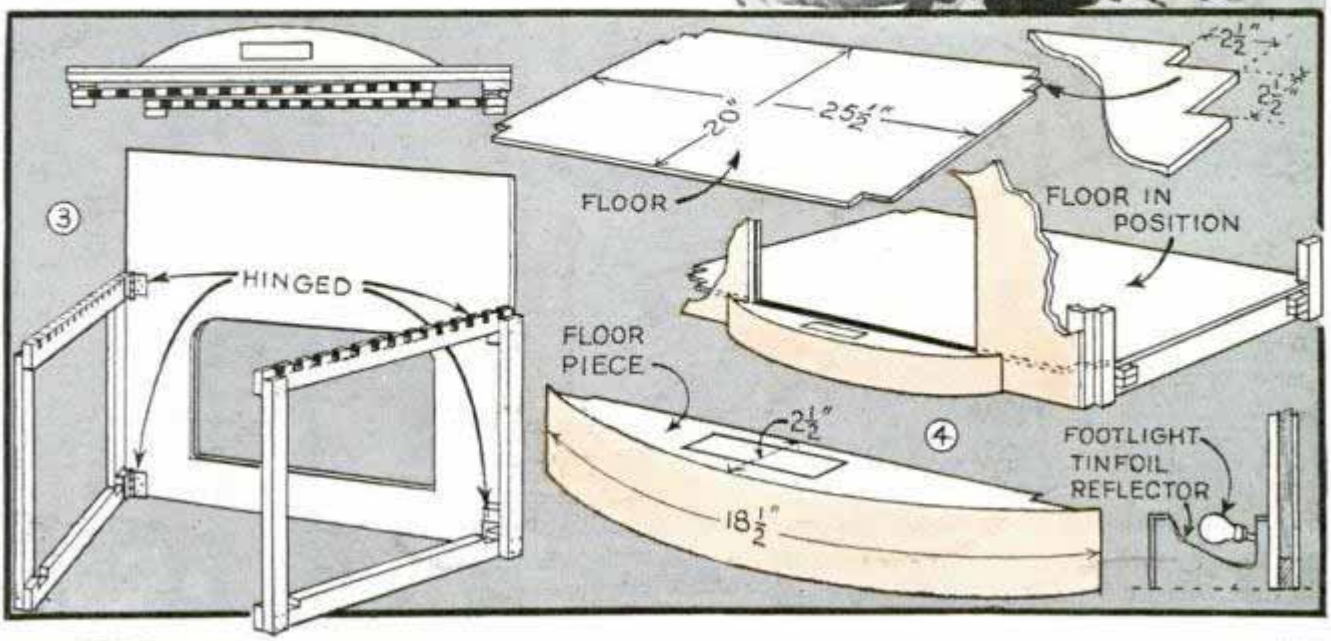


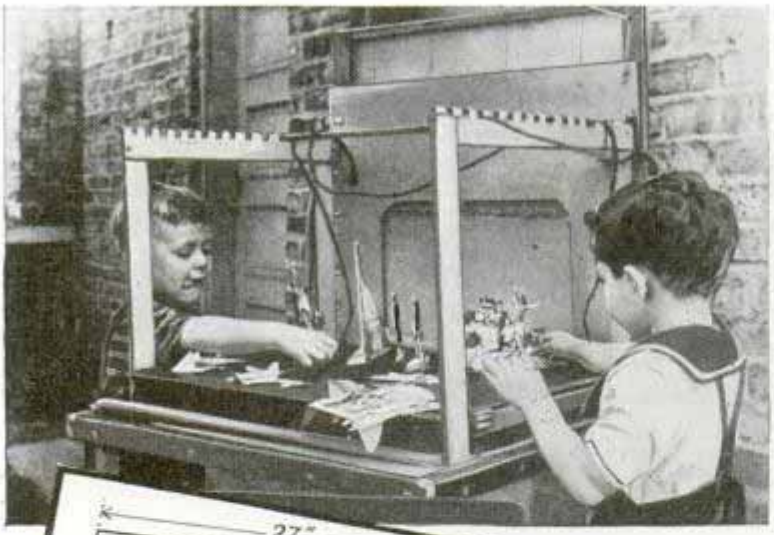
Fairy tales and animal stories enacted in this folding table-top theater completely equipped with scenic sets, drops, curtain, electric lights and cut-out actors

it, as detailed in Figs. 1 to 4 inclusive. Two crosspieces support the stage floor and keep the side frames open in the proper position, Fig. 4. Details of the construction are shown in the drawings.

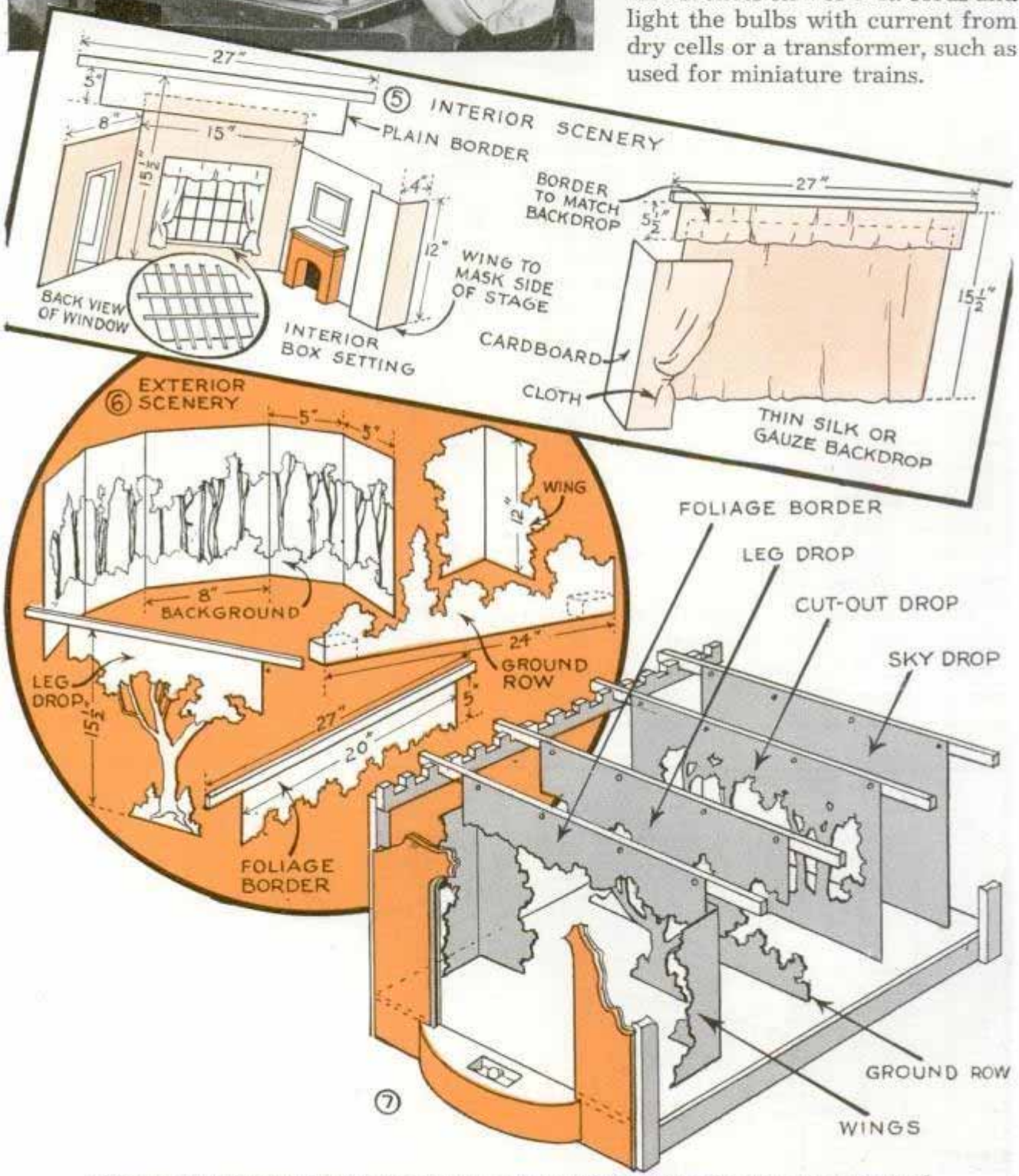
Scenery either hangs from the crossbars resting on the side arms or stands upon the floor supported by a cardboard easel or a small block glued behind each piece, Figs. 5, 6 and 7. Cardboard is used for scenery and is colored with wax crayons or opaque water color. Dry colors purchased at a paint store and mixed with glue and whiting make a cheap and satisfactory paint. This paint gives a relief effect frequently desirable in making up miniature scenery. The colored cutout books sold in the dime stores are a splendid source of material for stage props, figures of people, furniture, scenery "set" pieces, etc. Doll furniture and miniature dolls may be used most effectively with this stage.

The theater can be illuminated in a variety of ways. A bridge lamp lowered directly over the stage or a small clamp-on lamp will provide ample light. A sheet of tinted Cellophane will add color effects. A





somewhat better result can be secured with Christmas-tree lights, changing the bulbs to get the proper atmosphere, for example, white for daylight; amber and red for sunset; red for fire; blue for night; green for storm, mystery, etc. Another method, permitting the lights to be moved to any part of the stage and turned on and off individually (by loosening the bulb), is to fasten several miniature sockets on 2 or 3-ft. cords and light the bulbs with current from dry cells or a transformer, such as used for miniature trains.



Of course, the scenery can be made up in most any design that suits your own fancy and ingenuity. For the table-top stage, cutouts are especially effective as they give needed depth to the various arrangements and are quickly shifted between acts

Replacing Lawnmower Roller

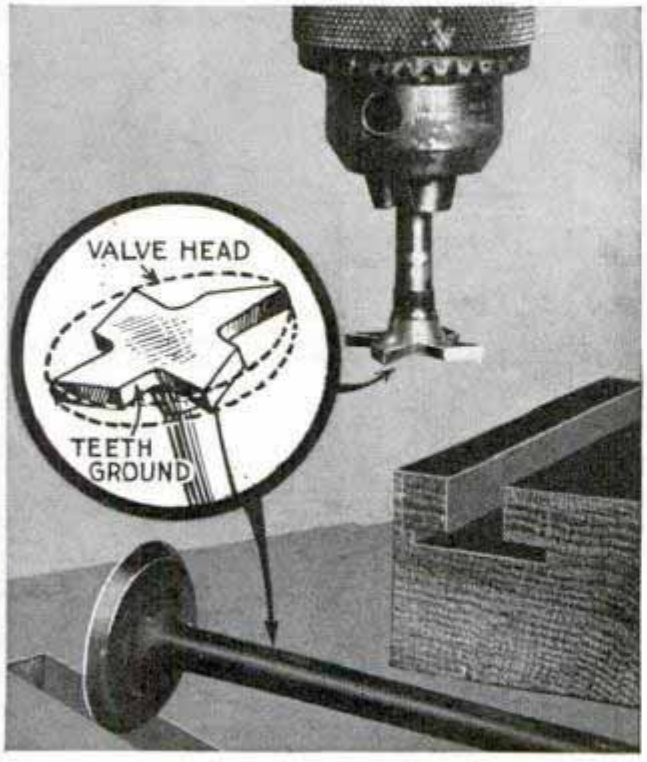
If the roller on your lawnmower is worn, it is a simple matter to make a new one of pipe. Get a piece the correct length and diameter and drive hardwood plugs tightly in the ends. If the old roller was drilled in the ends to provide bearings, do the same with the new one. If pins in the ends of the old one fitted in bearings in the mower frame, use lag screws of the proper size in the new roller as a substitute. The heads of the screws can be sawed off if necessary.

—Horace Taylor, Anderson, Ind.

Groove Cutter from Motor Valve Makes T-Shaped Slot

The problem of finding a cutter to make a T-shaped slot in a sliding rail for an extension table was solved by making a cutter from a poppet valve. The head of the valve was first ground slightly hollow on both the top and stem side. Four teeth were then ground as shown, being careful to make them all the same length. The T-part of the groove was cut on a drill press after the straight part of the groove had been cut on a table saw.

—R. L. Asbury, Denver, Colo.



Dirty Water Kept Out of Cistern by Automatic Valve

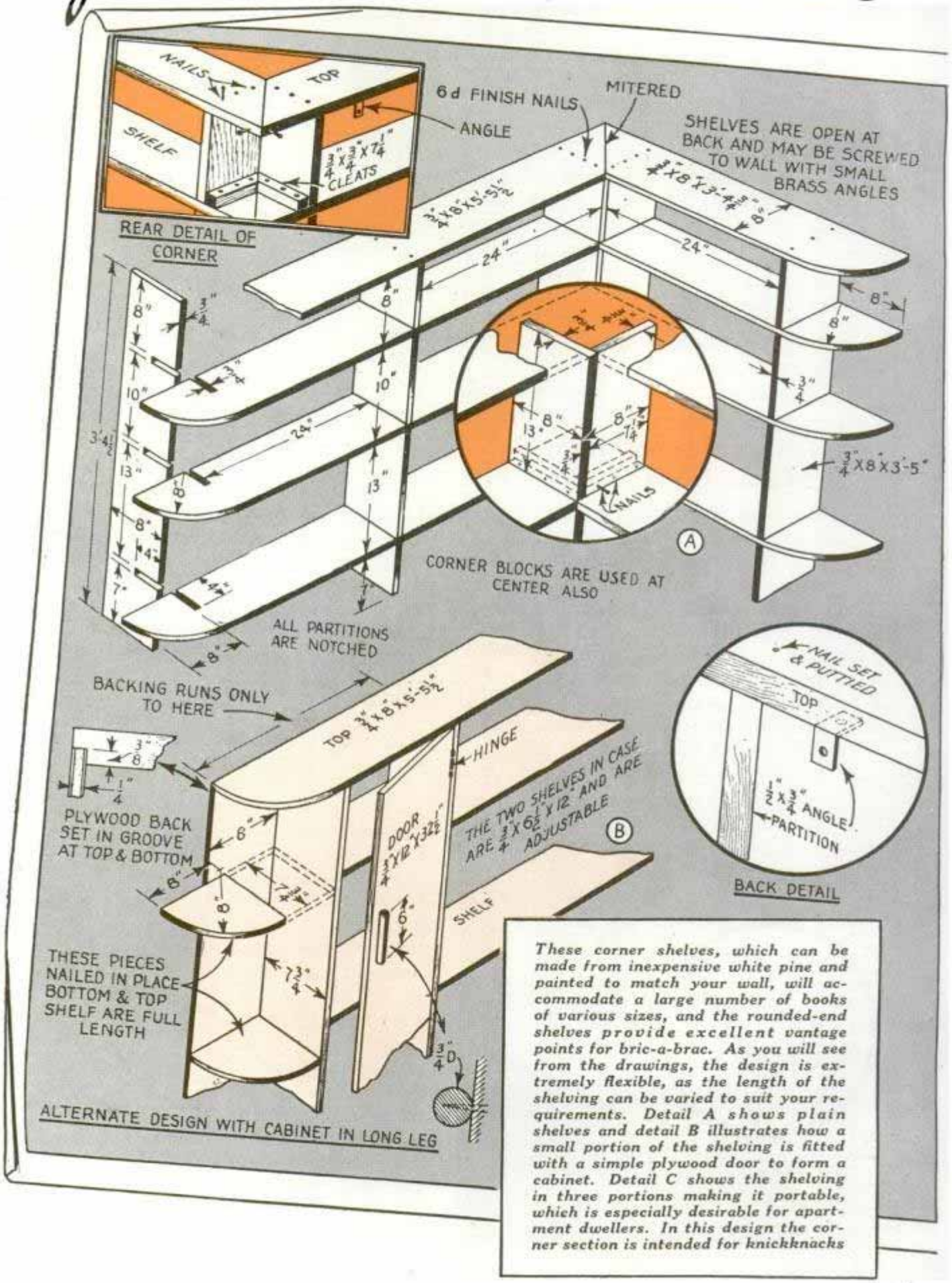
With this simple apparatus fitted on the downspout cut-off, you collect the dirty water in a keg, barrel or tub. When the latter is about two-thirds full, a float raises a release lever, which throws the valve over to direct the water into the cistern. The valve handle is attached to a coil spring, which assures that the valve will be pulled over quickly.

Woolens Stored in Large Cans to Avoid Moths

Moths can't get in woolen articles such as scarfs, caps, socks, mittens, etc., if you put them in large tin cans that have tight-fitting lids. Before storing the articles, I wash them carefully in warm soapsuds, rinse them several times in lukewarm water and dry them outdoors. When dry, they are immediately folded and stored in the cans.—E. Swope, Danville, Pa.

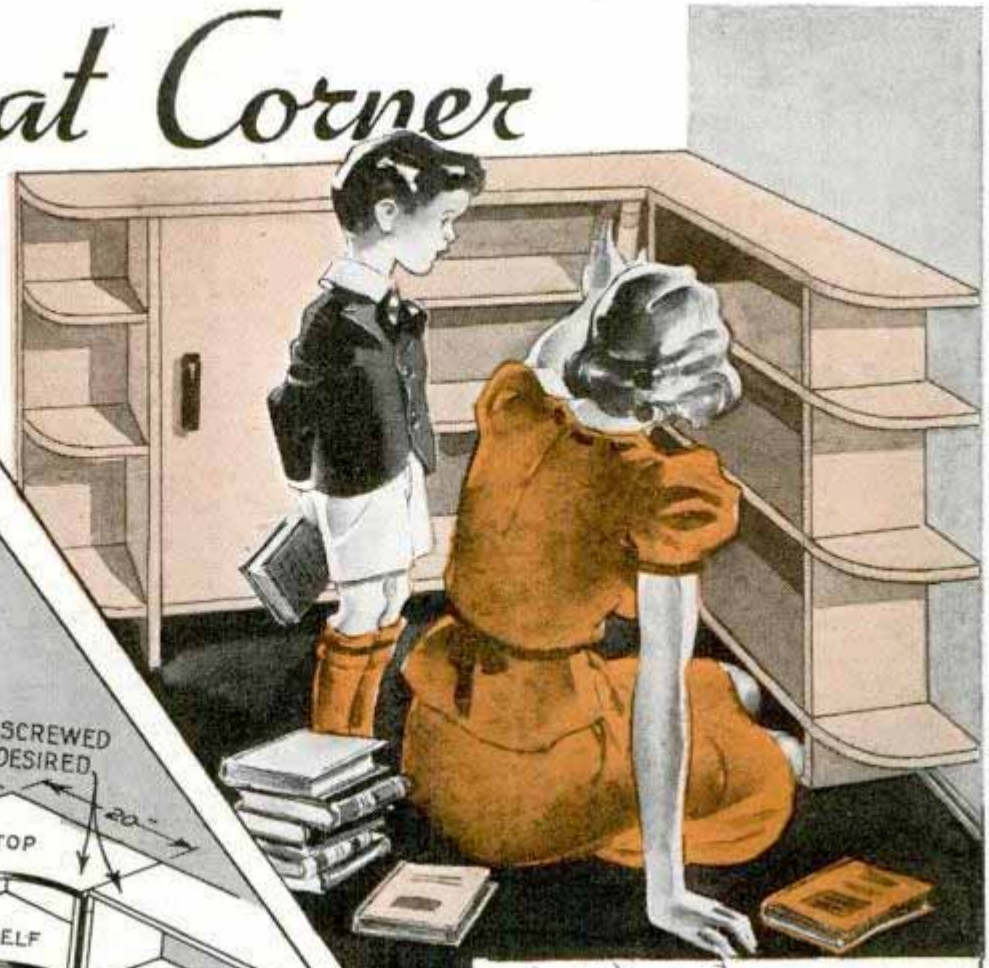
When airing an inner-spring mattress never hang it over the foot of the bed as the springs in the center may loosen.

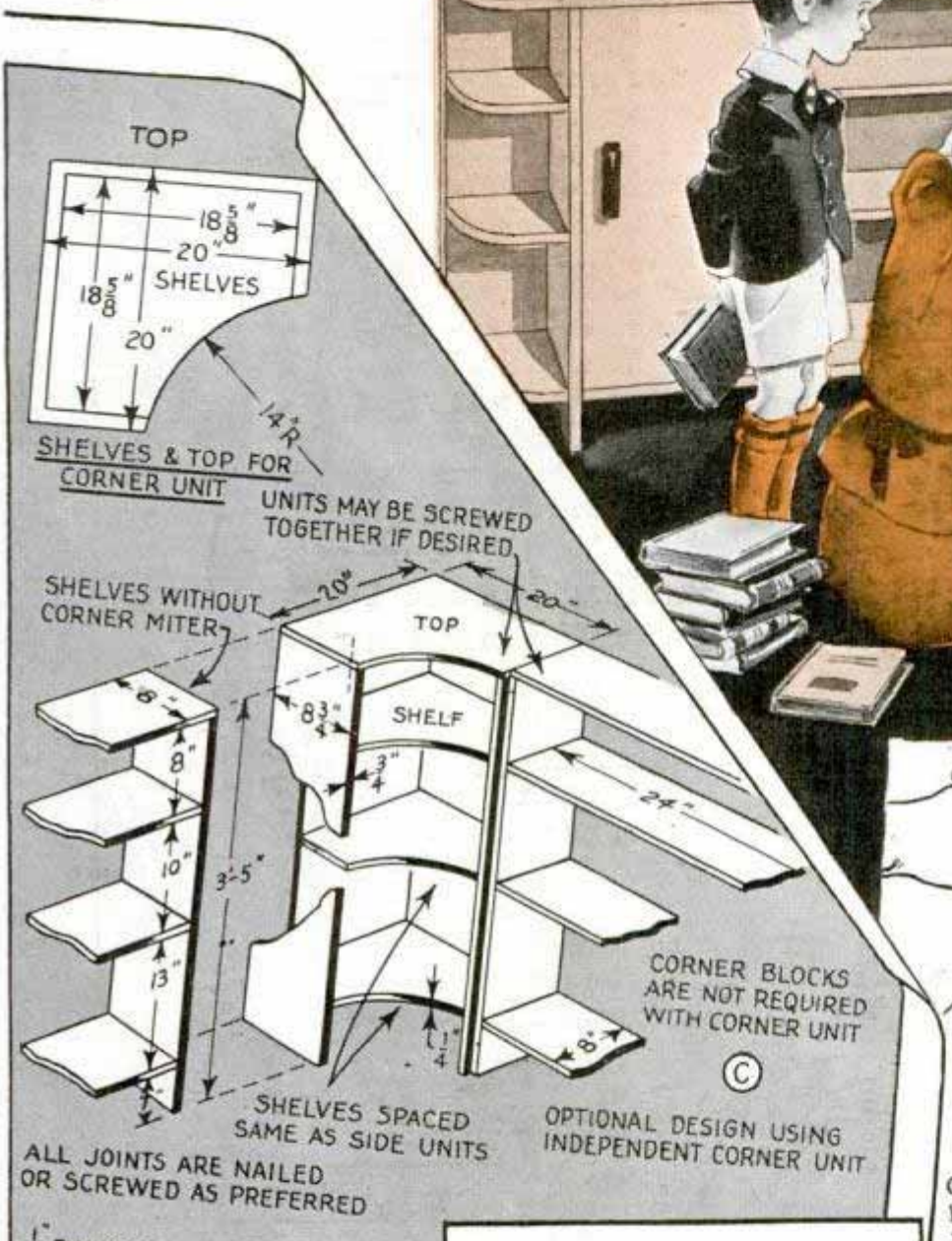
Open BOOK SHELVES

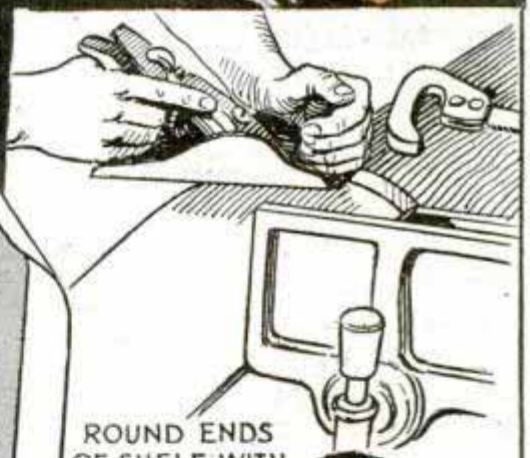

NAILS
TOP
SHELF
3/4 X 3/4 X 7 1/4 CLEATS
REAR DETAIL OF CORNER
6d FINISH NAILS
MITERED
ANGLE
SHELVES ARE OPEN AT BACK AND MAY BE SCREWED TO WALL WITH SMALL BRASS ANGLES
3/4 X 8 X 5'-5 1/2"
3/4 X 8 X 3'-4 3/4"
24"
8"
10"
13"
3'-4 1/2"
7"
3/4 X 8 X 3'-5"
NAILS
A
CORNER BLOCKS ARE USED AT CENTER ALSO
ALL PARTITIONS ARE NOTCHED
BACKING RUNS ONLY TO HERE
TOP 3/4 X 8 X 5'-5 1/2"
HINGE
PLYWOOD BACK SET IN GROOVE AT TOP & BOTTOM
DOOR 3/4 X 12 X 32 1/2"
THE TWO SHELVES IN CASE ARE 3/4 X 6 1/2" X 12" AND ARE ADJUSTABLE
B
SHELF
THESE PIECES NAILED IN PLACE BOTTOM & TOP SHELF ARE FULL LENGTH
ALTERNATE DESIGN WITH CABINET IN LONG LEG
NAIL SET & PUTTIED
TOP
1/2 X 3/4 ANGLE
PARTITION
BACK DETAIL

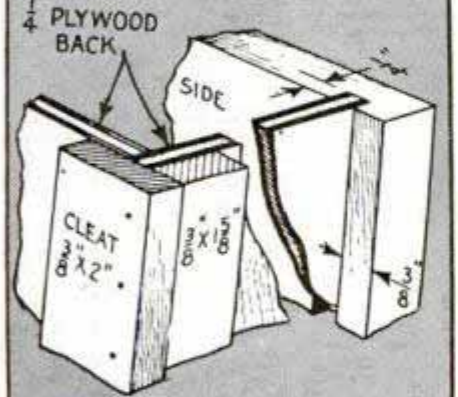
These corner shelves, which can be made from inexpensive white pine and painted to match your wall, will accommodate a large number of books of various sizes, and the rounded-end shelves provide excellent vantage points for bric-a-brac. As you will see from the drawings, the design is extremely flexible, as the length of the shelving can be varied to suit your requirements. Detail A shows plain shelves and detail B illustrates how a small portion of the shelving is fitted with a simple plywood door to form a cabinet. Detail C shows the shelving in three portions making it portable, which is especially desirable for apartment dwellers. In this design the corner section is intended for knickknacks

for that Corner





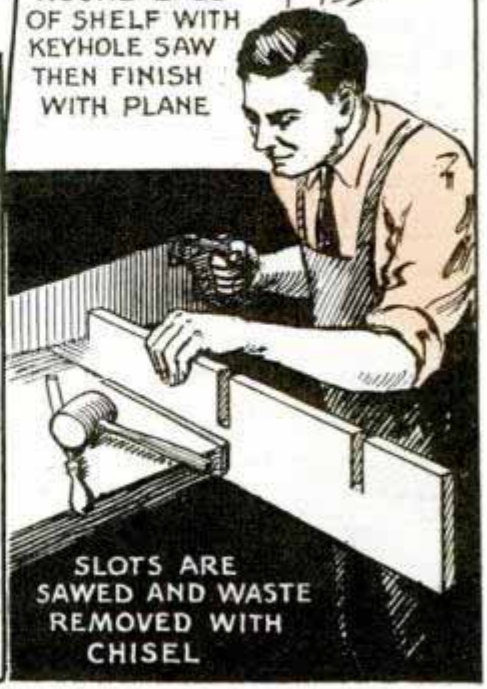




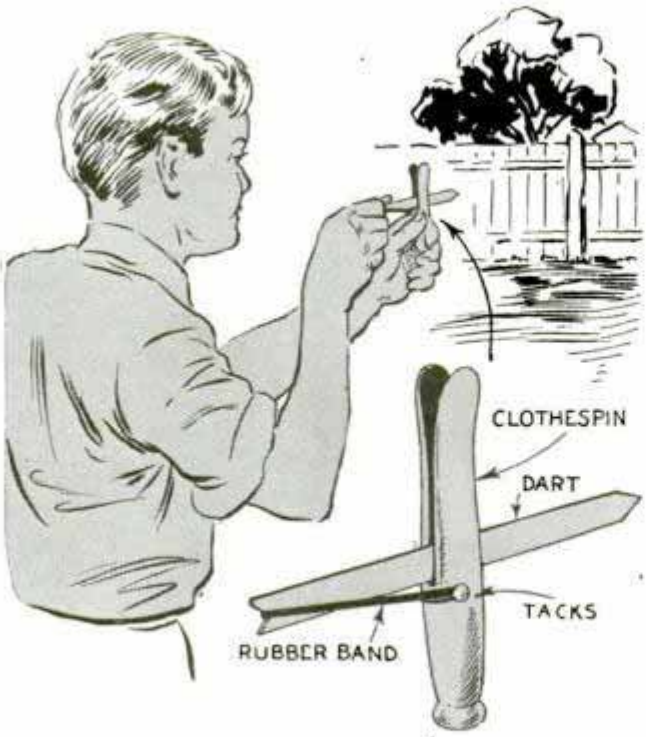
DETAIL SHOWING CORNER-UNIT BACKING ARRANGEMENT

MATERIAL LIST

Shelf (A)
4 pcs. pine—¾ x 8 x 65½ in.—shelves
4 pcs. pine—¾ x 8 x 40¾ in.—shelves
3 pcs. pine—¾ x 8 x 40¼ in.—partitions
1 pc. pine—¾ x 8 x 8 in.—corner piece
1 pc. pine—¾ x 7¼ x 8 in.—corner piece
1 pc. pine—¾ x 8 x 10 in.—corner piece
1 pc. pine—¾ x 7¼ x 10 in.—corner piece
1 pc. pine—¾ x 8 x 13 in.—corner piece
1 pc. pine—¾ x 7¼ x 13 in.—corner piece
1 pc. pine—¾ x 8 x 7 in.—corner piece
1 pc. pine—¾ x 7¼ x 7 in.—corner piece
Additional for case (B)
1 pc. pine—¾ x 12 x 32½ in.—door
1 pc. pine ¾ x 8 x 40¼ in.—partition
1 pc. plywood—¼ x 21⅛ x 33 in.—back
Additional for corner unit (C)
2 pcs. pine—¾ x 8¾ x 40¼ in.—sides
3 pcs. pine—¾ x 18⅝ x 18⅝ in.—shelves
1 pc. pine—¾ x 20 x 20 in.—top
2 pcs. pine—¾ x 8 x 40¼ in.—shelf ends
2 pcs. plywood—¼ x 19⅛ x 19⅛ in.—back
2 pcs. pine—⅜ x 2 x 33½ in.—cleats



Dart Shooter from Clothespin and Rubber Band



A clothespin and rubber band assembled as shown provide a dandy shooter for small wood darts. A strong band cut from an old inner tube is just the thing and will send the dart a good many feet through the air.

Nail File Points Pencil Lead

Bent to clip over the edge of your drawing board, a long nail file makes a good pencil pointer. It may be necessary to heat the file so it can be bent easily to the proper shape.

Jewelry-Chain Ring Is Handy as Electric-Meter Connector

If you work with low-voltage electric meters, you can save time by using the rings from the ends of old watch and jewelry chains to connect them to binding posts. As indicated in the photo, the meter is attached by opening the ring and slipping it over the binding-post screw head.

—Frank Bentley, Clinton, Ia.

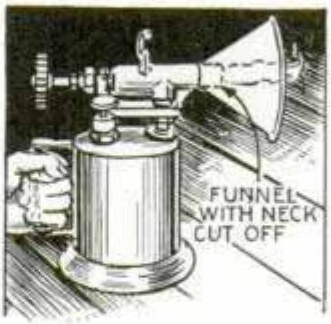
Newsboy Removes Papers Easily from This Open-End Bag

To remove papers one at a time easily, a newsboy uses a carrying bag open at both ends like the one shown. It consists of a piece of canvas hemmed at the ends to take lengths of broomsticks. These are drilled at the ends to receive a length of sash cord.

Sandbag Prevents Ladder Slipping on Hard Surfaces

One sign painter sets his ladder on a sandbag to prevent it from slipping on cement walks or frozen ground. The sand is equally divided and the empty, middle portion of the bag is wrapped with twine or tape. This portion serves as a carrying handle in moving the bag.

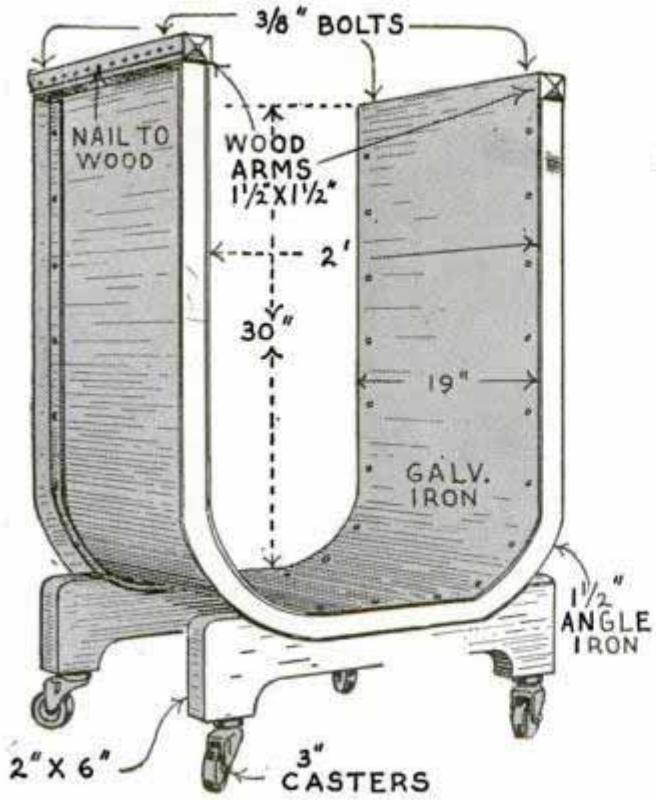
Funnel Windshield on Blowtorch Aids When Burning Paint

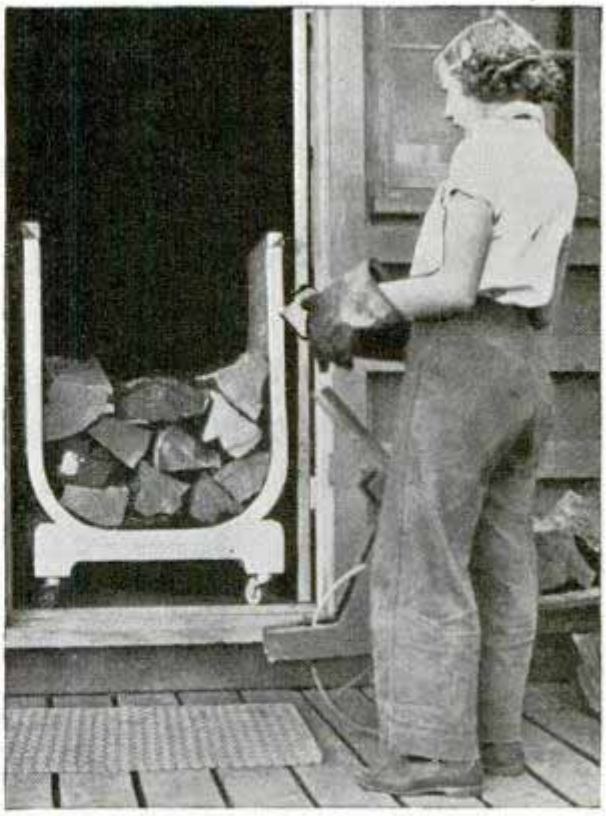


While removing paint with a blowtorch, I find that the wind usually blows the flame away from the spot to be heated. This, of course, results in a waste of time. In order to avoid this, I obtained an old funnel, cut off the neck, and made the hole large enough to fit the torch. There will be an increase in heat also, and you will be able to burn larger areas of paint at a time.

—Anthony T. Burgio, Brooklyn, N. Y.

Wood Box on Casters Carries a Large Load

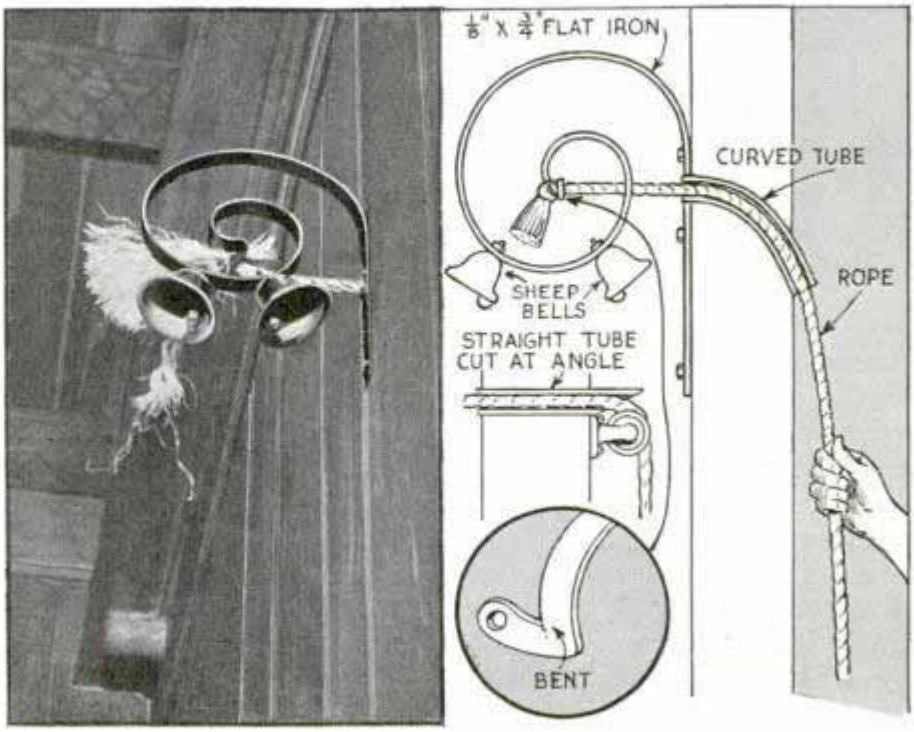




This wheeled box keeps a large supply of wood conveniently at hand and saves carrying it into the house by the armful, as the box can be pushed to an outside door and filled from a wheelbarrow. It consists of No. 28-gauge galvanized sheet iron attached to a 1½-in. angle-iron frame by means of stove bolts, and the frame is bolted to two wooden rails carrying large, rubber-tired casters. Two arms or stretchers of wood, 1½ in. square, are fastened across the top between the angle-iron frame members, the top ends of the latter being cut and bent over to form lugs to which the arms are bolted. The sheet metal is bent around the arms and nailed to them.

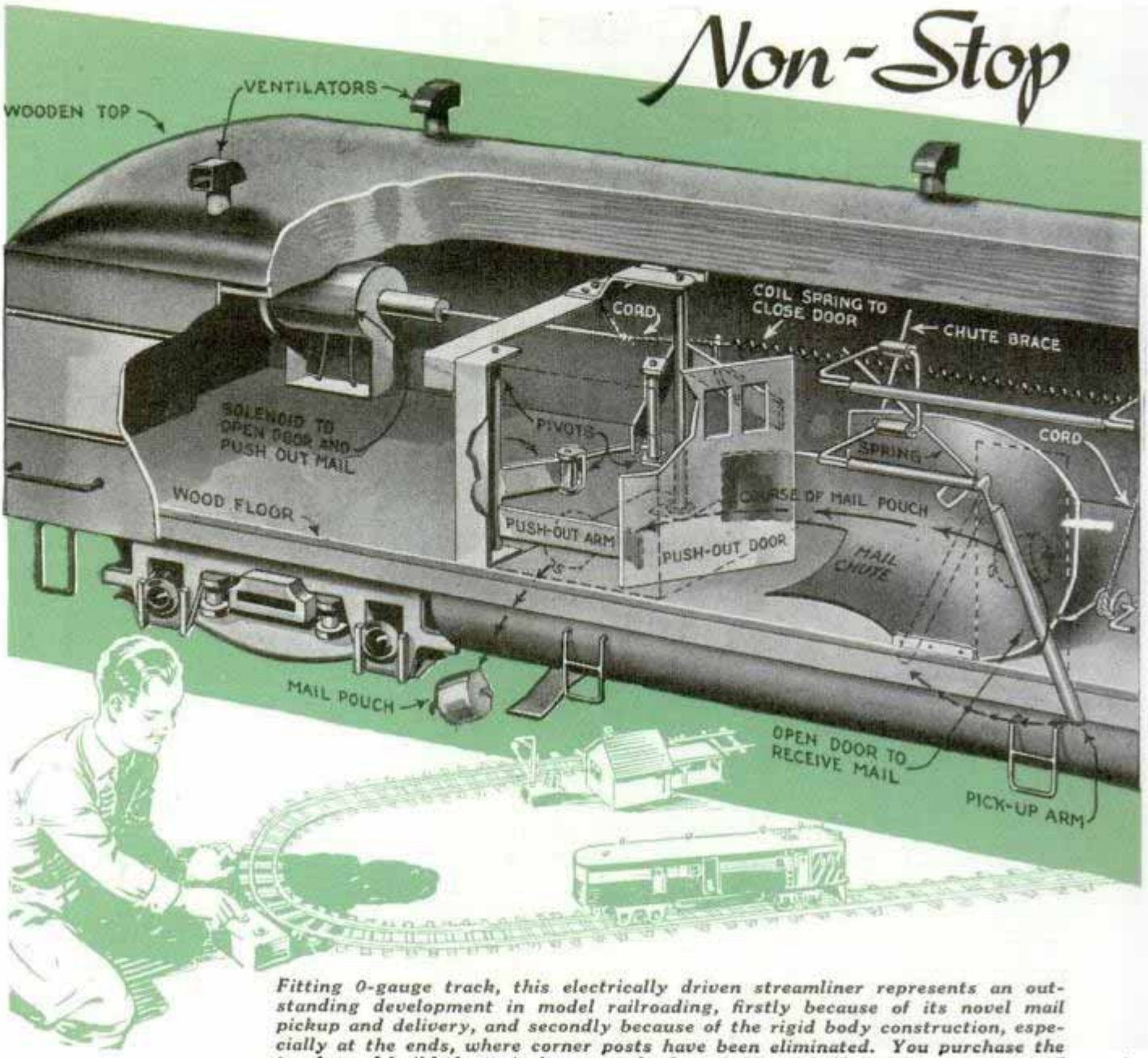
Jingle of Sheep Bells on Cottage Door Announces Caller

A gentle tug at the rope makes the bells jingle merrily. They are attached to a spiral of flat iron, which is screwed to the door. A sleeve of copper tubing, which you can pick up at any garage, protects the rope from fraying, the tubing being flared and the burr at the edges removed. Paint the metal flat black and use a white tape with a tassel at each end to give a finished appearance.



Kerosene poured down sink drains will help to keep them clean.

Non-Stop



Fitting 0-gauge track, this electrically driven streamliner represents an outstanding development in model railroading, firstly because of its novel mail pickup and delivery, and secondly because of the rigid body construction, especially at the ends, where corner posts have been eliminated. You purchase the ***trucks and build the train from standard stock material. No castings are required***

By ALEXANDER MAXWELL

PART I—Chassis, motor installation, ejector switch, body and minor fittings

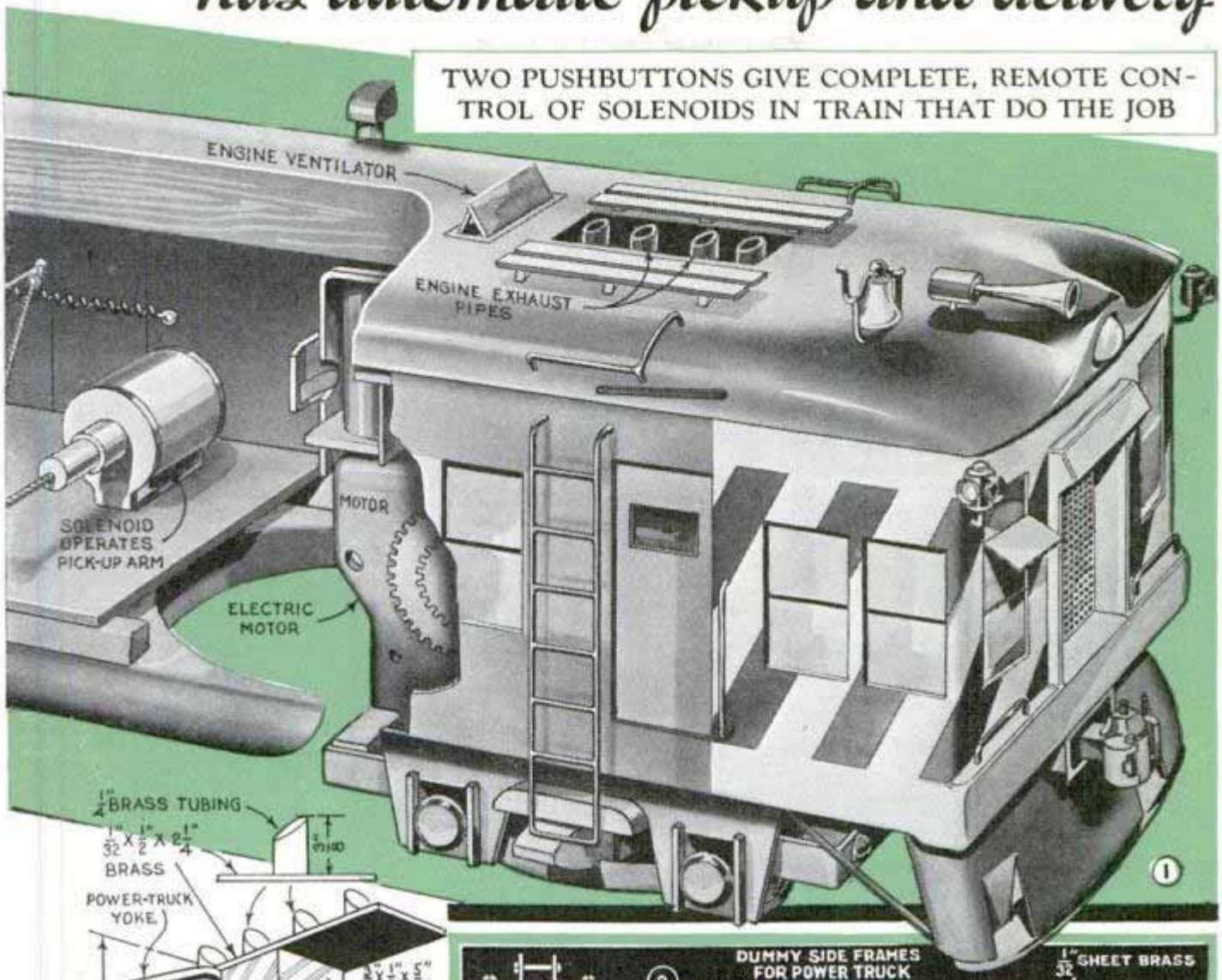
A POUCH hangs from the mail crane at the station platform and as the fast "gas-electric" goes past, a pickup arm rises and the pouch disappears into the car. Another pouch is hung on the crane. As the car completes the loop and returns to the station, it slows momentarily, the express door opens and a pouch is tossed onto the platform. On the way out, the second pouch is taken from the mail crane. All this action is caused by electromagnets and a system of levers inside the train as illustrated in Fig. 1, and a magnet in the track bed. The mechanism is controlled by a couple of push buttons conveniently located near the operator.

While the building of this train looks complex, its construction is relatively simple. A drill press is handy but no other power tools need be considered. Such fittings as wheels, bell, couplers, etc., are stocked by model houses and are cheaper to buy than to make. Two grades of solder are needed; an extra hard and a very soft solder. Driving power for the train is supplied by an electric toy-train motor of the kind shown in Figs. 5 and 6. You can pick up a secondhand one or buy a new "replacement unit." Cut down the wheel flanges to fit the scale track, install a swivel and also provide dummy side frames, Fig. 2, to match the standard roller-bearing

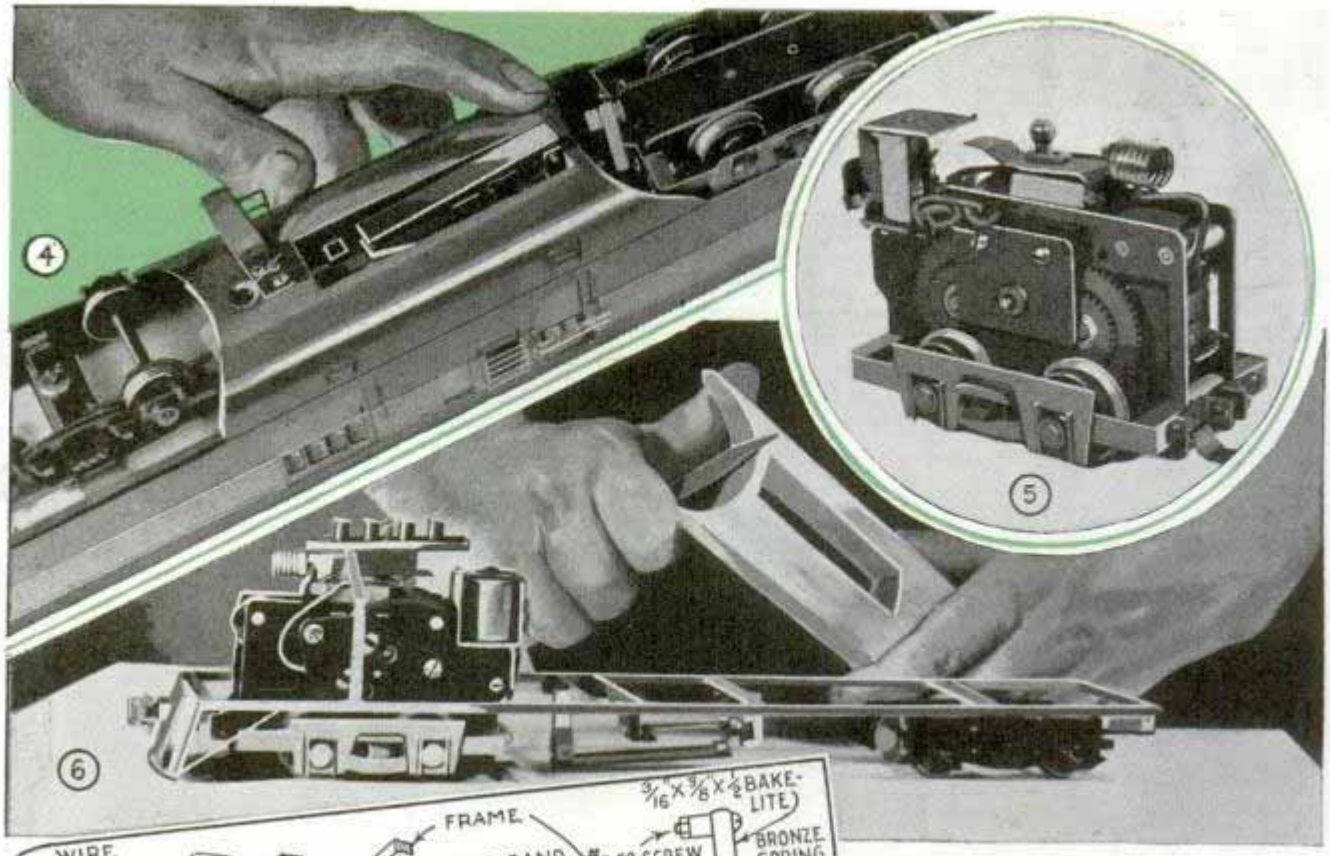
MAIL EXPRESS

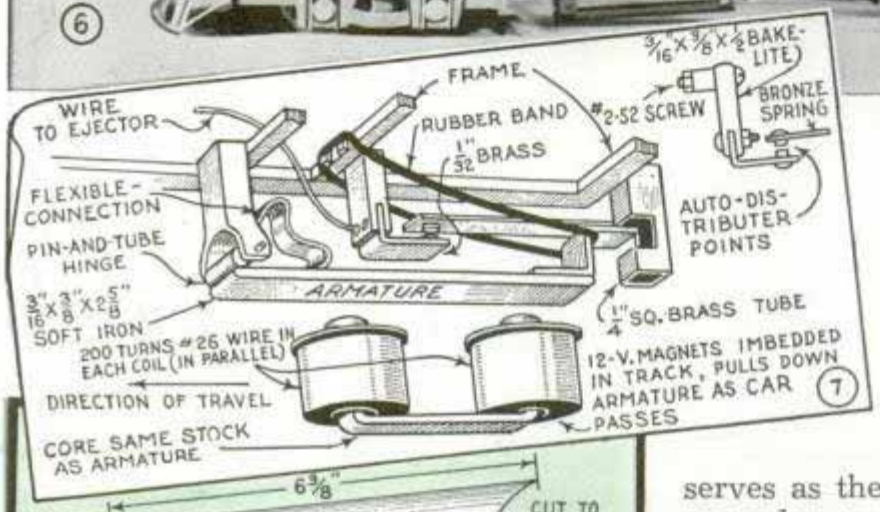
has automatic pickup and delivery

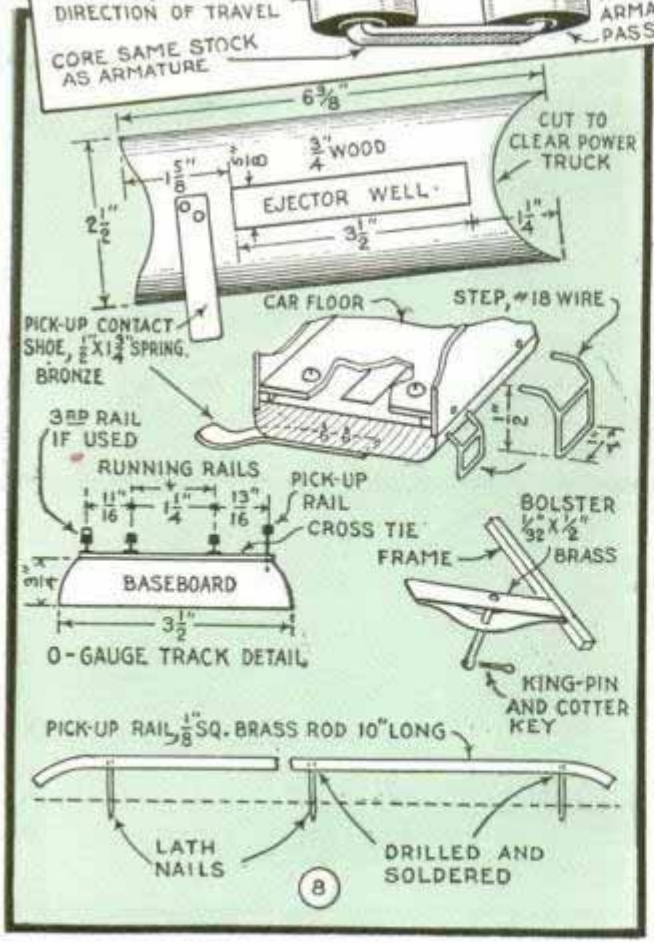
TWO PUSHBUTTONS GIVE COMPLETE, REMOTE CONTROL OF SOLENOIDS IN TRAIN THAT DO THE JOB



FRAME, INCLUDING POWER-TRUCK YOKE AND METHOD OF ATTACHING POWER TRUCK



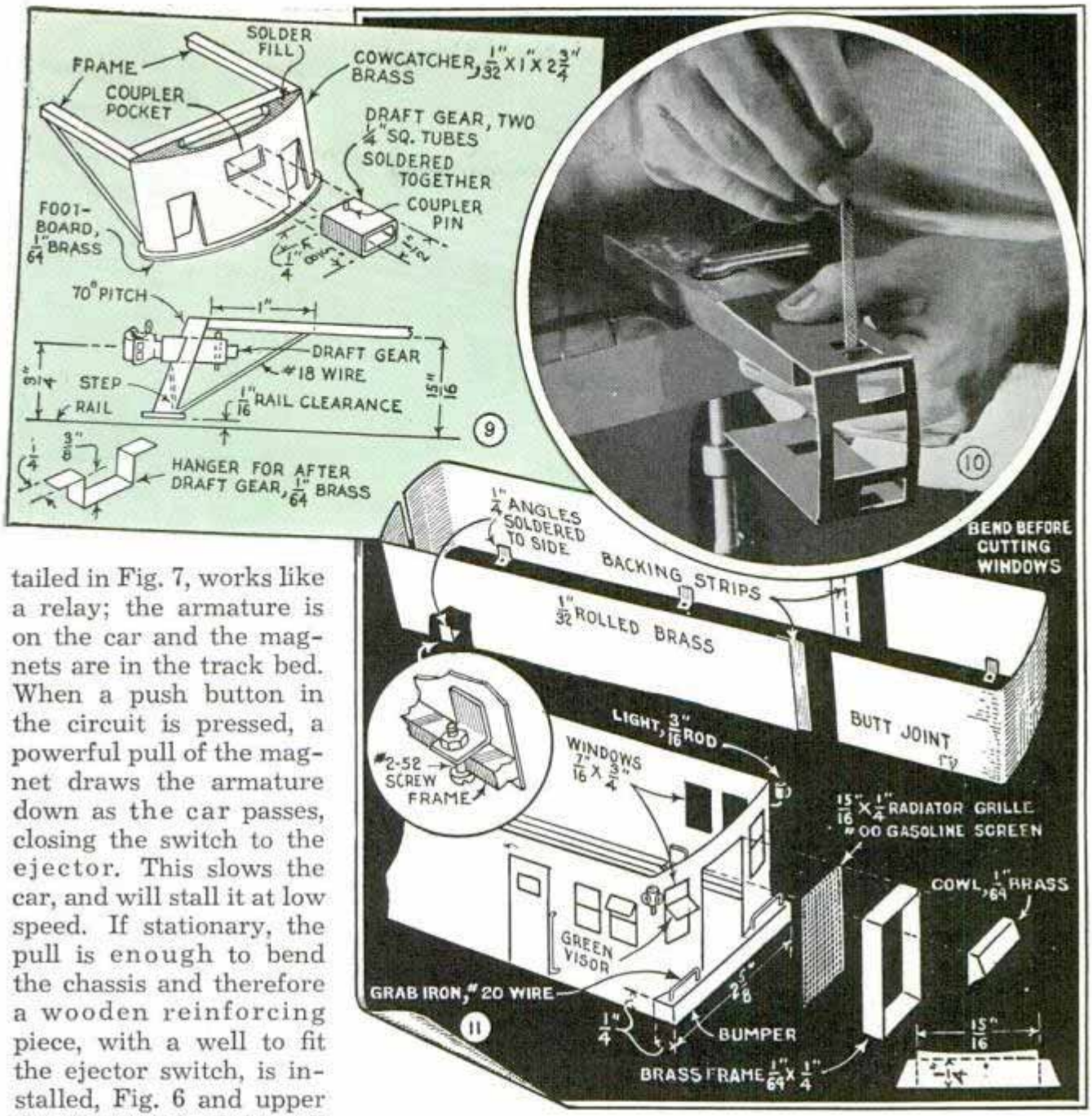




trailer truck you are to use. Dimensions cannot be given as they depend upon the motor you have.

The frame, Fig. 3, is made from square brass rod nailed in position on a board and then soldered. The yoke at the front end serves as the motor-truck bolster. To go around curves, the entire motor unit must be free to swivel and therefore it is suspended from a ball-and-socket joint. The socket is a piece of solid brass on which a strip holding the "exhaust pipes" is fitted and the unit is soldered to the yoke with hard solder. Damp cotton stuffed in the exhaust pipes will keep them from pulling loose when soldering to the yoke. The motor bracket should be high enough to allow the chassis to clear the track by 15/16 in. The trailer truck bolster, shown in the circular insert of Fig. 3, acts as a leveling device for the chassis. Use extreme care in centering the pin. As soon as both trucks are attached, run the chassis on the track and measure for tendency to list to left or right. If this is the case unsolder one end of the bolster to correct it.

With the chassis in running condition we will turn our attention to the ejector mechanism. The control switch shown on the underside of the chassis, Fig. 4 and de-

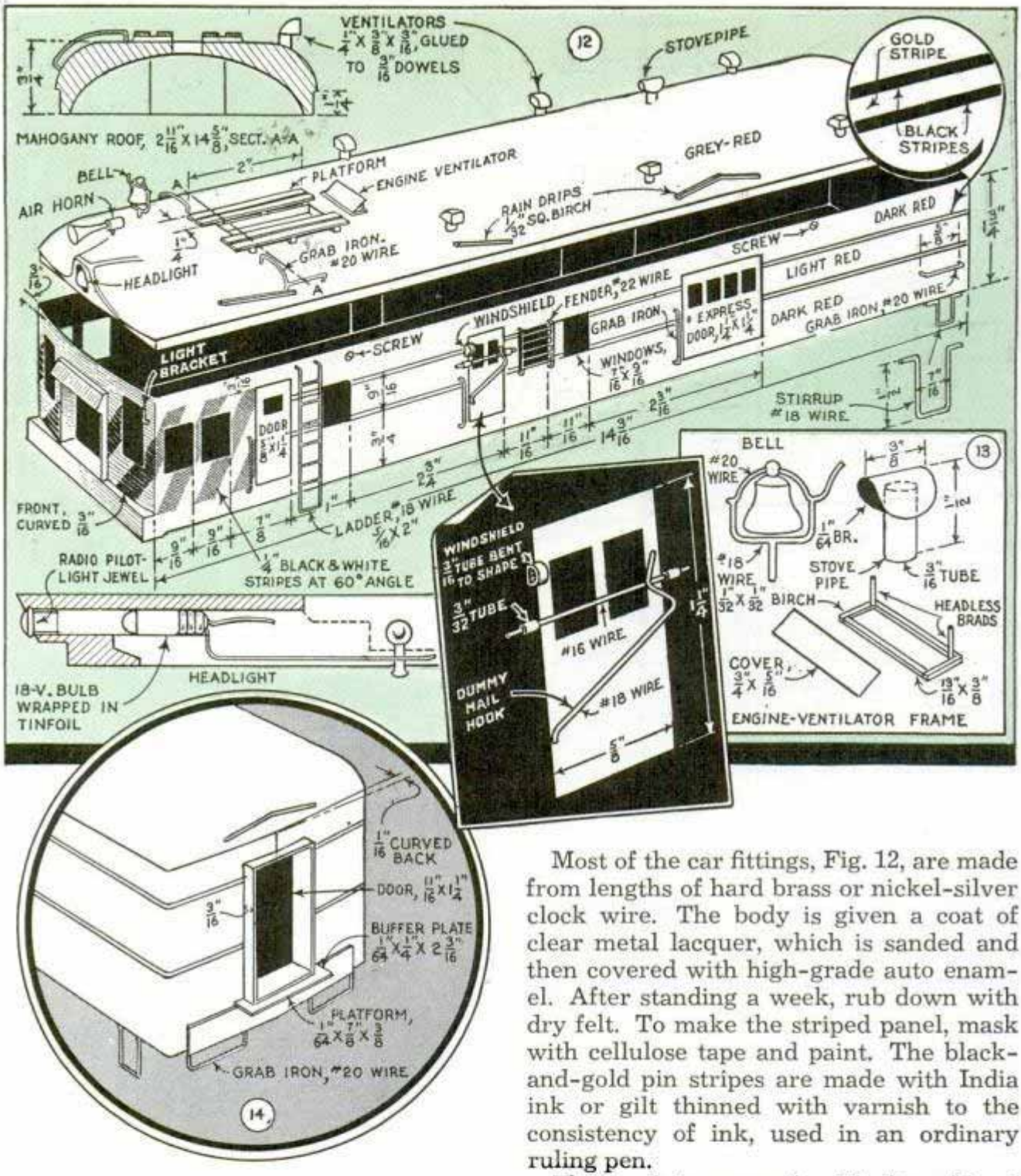


tailed in Fig. 7, works like a relay; the armature is on the car and the magnets are in the track bed. When a push button in the circuit is pressed, a powerful pull of the magnet draws the armature down as the car passes, closing the switch to the ejector. This slows the car, and will stall it at low speed. If stationary, the pull is enough to bend the chassis and therefore a wooden reinforcing piece, with a well to fit the ejector switch, is installed, Fig. 6 and upper detail of Fig. 8. If the pull of the magnets is too violent, insert a rheostat in the line. If the pull is weak, raise the voltage or take off some turns from the magnets. If still weak, rewind with heavier wire. Satisfactory results were obtained by using magnets as specified in Fig. 7. The magnet bobbins are brass, fiber or heavy paper. The winding of both magnets should be in the same direction. The ends of the core should be flush with the track, and there should be a 1/32-in. air gap between them and the armature.

The cowcatcher, Fig. 9, is bent to shape next. Solder it to the headboard of the chassis and fill the cavity between with soft solder. To prevent near-by joints from opening while soldering, grasp the metal with wide-jaw pliers to conduct the heat away. Automatic couplers and draft gear are commercially available but couplers that must be linked by hand will serve.

Track dimensions are given in Fig. 8. The wider and more sweeping your curves are, the faster you can run your car; a 48-in. is good but 60 in. is better. The mailbag pickup requires a short length of special rail. The contact shoe is fastened to the underbody as in Fig. 8, high enough to clear the third rail.

The car body, Figs. 10 and 11, is unusual in design as only three pieces of 1/32-in. sheet brass are used. By eliminating corner joints, strength is increased and boxcar appearance is eliminated. See Figs. 11 and 14. The body is fastened to the frame as in Fig. 11. Lay out the doors and windows, then drill and file to dimensions with a set of Swiss files. For illumination while



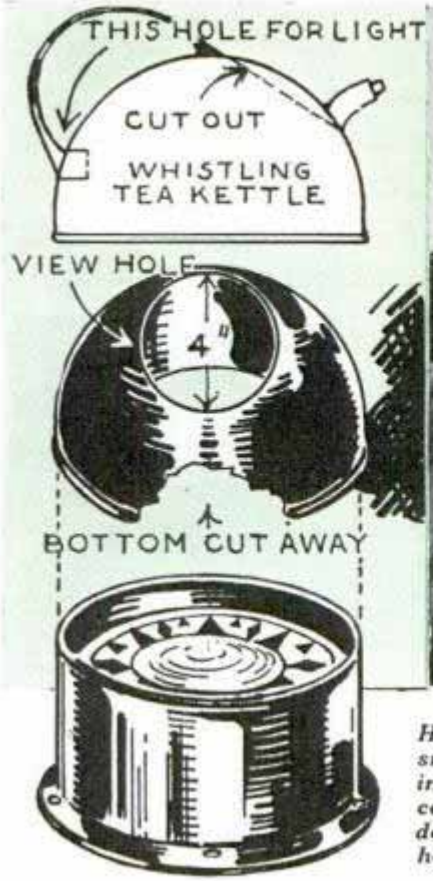
filing, use a light which is almost horizontal, as in Fig. 10, so that the scriber marks will be very easy to see. Cut the radiator frame in one piece, fit in place and solder. The gasoline screen grill must be handled carefully as solder flows through the mesh rapidly. Tack it lightly with a spot of solder at each corner. Fill the space between the cab and the bumper with soft solder and file smooth. The fill need not extend downward more than 1/16 in. from the top. Rhinestones for the marker lamps come from dime-store jewelry and are held in their sockets with celluloid cement. Opal or frosted celluloid makes good windows.

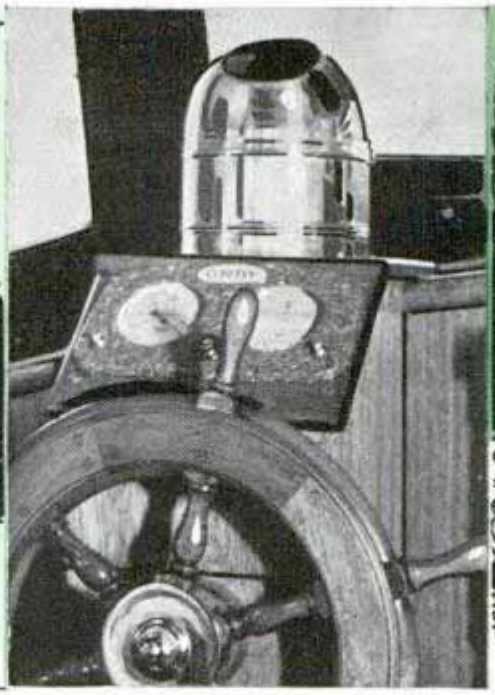
Most of the car fittings, Fig. 12, are made from lengths of hard brass or nickel-silver clock wire. The body is given a coat of clear metal lacquer, which is sanded and then covered with high-grade auto enamel. After standing a week, rub down with dry felt. To make the striped panel, mask with cellulose tape and paint. The black-and-gold pin stripes are made with India ink or gilt thinned with varnish to the consistency of ink, used in an ordinary ruling pen.

The roof is secured with four No. 2 round-head wood screws. A spindle shaper or molding cutter head is handy to shape the edges of the roof except the front which is shaped with a gouge, and the after end which is dressed down with a block plane. Use sandpaper until all tool marks are removed. Bumps or score marks destroy the beauty of an otherwise perfect model. The skylight, platforms and raindrips are installed before painting. Holes are drilled for the other fittings, some of which are shown in Fig. 13 and these are put on after painting.

(To be continued)

Whistling Teakettle Forms a Binnacle Case





Having a 4-in. mariners' compass often used on small cabin boats, a binnacle case to fit it was improvised from a whistling teakettle of the copper-chromium variety, costing a dollar. The details show the portions cut away, leaving a view hole and a smaller hole to take an auto dash light

Spiral Cut from Sheet of Paper Turns Slowly on Lamp

Anybody can cut a spiral from a sheet of paper and mount it on a pointed wire or pin over a lamp, the heat of which will cause the spiral to turn slowly. The wire is bent to form a circle to nest on the rounded portion of the bulb after which one end of the wire is brought toward the center and up vertically so that it projects about an inch or so above the bulb. The end of the wire should be filed to a point, or a pin may be tied or soldered to it. If a very slight impression is made in the center of the spiral which will cause it to seat on the point, there will be no appreciable friction and the spiral will start to rotate slowly as soon as it becomes warm.

Rubber Caster Cup to Remove Screw Caps and Covers

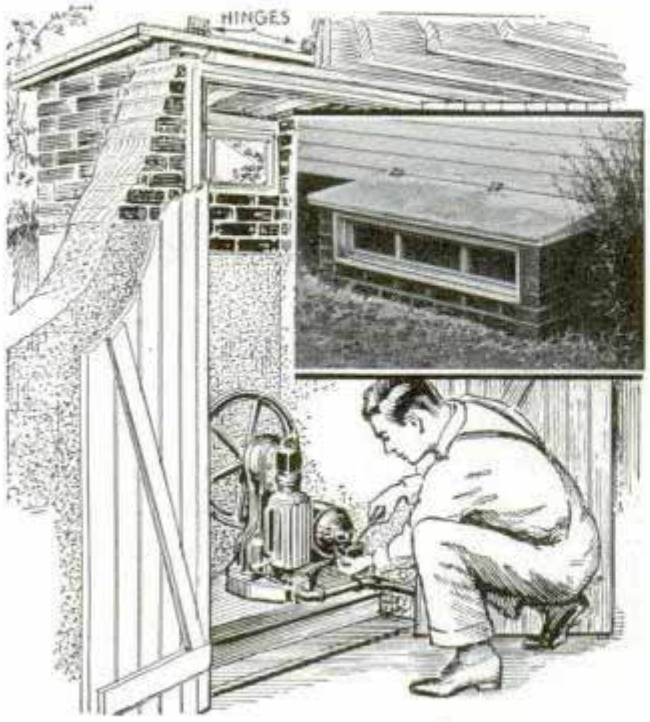
Keep a rubber caster cup around your workbench and you will find it handy for removing smooth screw caps and covers of radio and electrical parts, and other articles that have smooth covers that are hard to grip to turn them. The caster is especially useful when removing the smooth, screw back of a watch. The cup provides a good grip for the hand, and when pressed firmly against a cap affords plenty of friction to turn it.

Pipe Forms Shallow Seed Trench in Garden Beds

To overcome trouble in making shallow seed trenches straight and at a uniform depth in your garden beds, try a length of pipe. In most cases, the weight of the pipe will cause it to sink into a well-prepared soil deep enough for the trench. If necessary, a little pressure on the pipe will do the trick.—E. W. LaRue, Trenton, N. J.

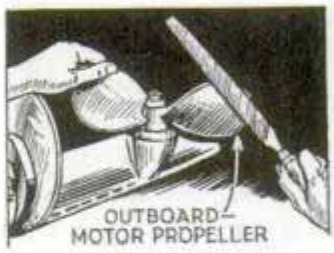
Pump Recess in Basement Wall Saves Space

In a home built in a small town beyond the water lines, the well pump was set in a narrow recess in the wall so that it would be out of the way, and also so that the pipes could be pulled for repairs if necessary. The recess has a narrow window to admit light, is inclosed from the basement proper with doors, and the roof is hinged.

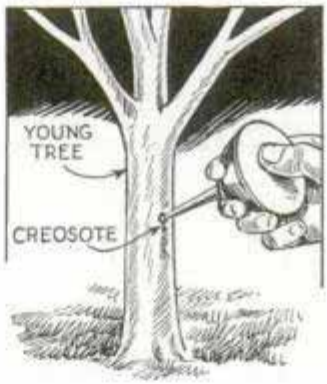


Rough Boat Propeller Smoothed to Increase Efficiency

If the surfaces of your boat propeller blades have become battered and the edges nicked from striking stones and other obstructions, smooth them with a file. This rough condition offers a resistance to clean rotating of the propeller in water and reduces speed of the boat because of the extra power that is required to turn the propeller.



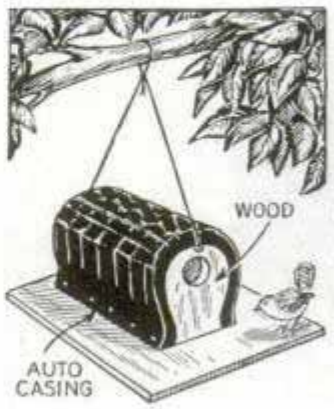
Killing Black Beetles in Trees



Little black beetles, that cause swellings in the stems of shrubs and young trees by boring into the wood, can be killed in the spring of the year by squirting a few drops of beechwood creosote into the holes where they entered. The creosote also disinfects the exposed wood and prevents further damage by fungi.

Wren House from Auto Casing

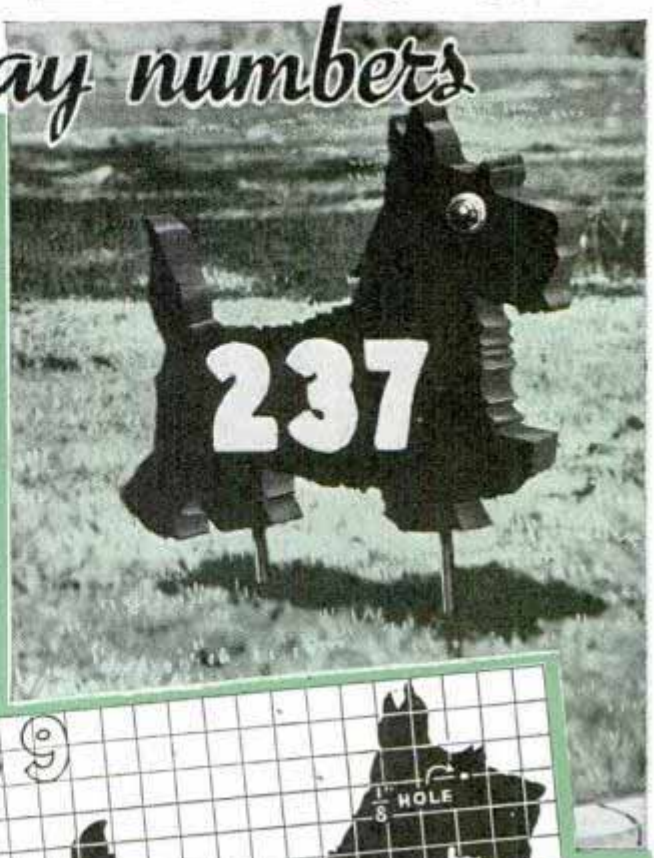
Jenny wren will appreciate this little house, which is nothing more than a short piece of auto casing fitted with wood ends cut to shape and nailed in place. A 1-in. hole bored in one end serves as a door, and a board nailed to the bottom of the casing and ends provides a base.

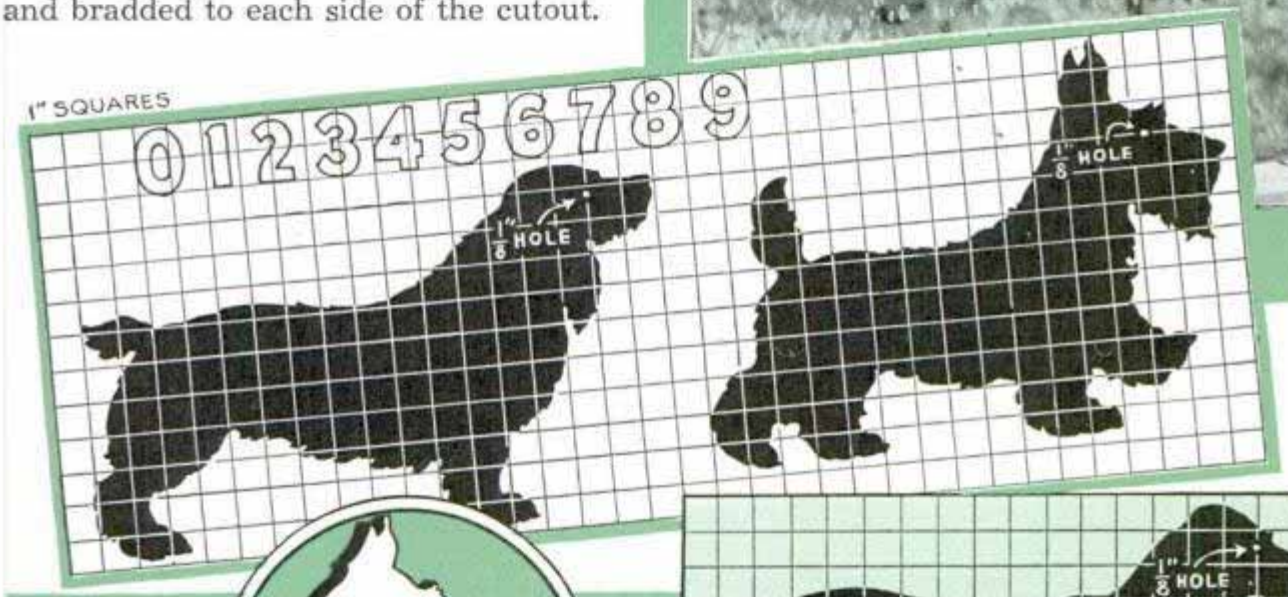


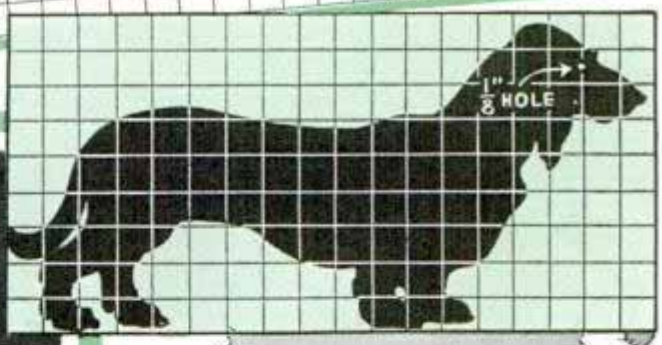
—C. L. Martin, Adams, Mass.

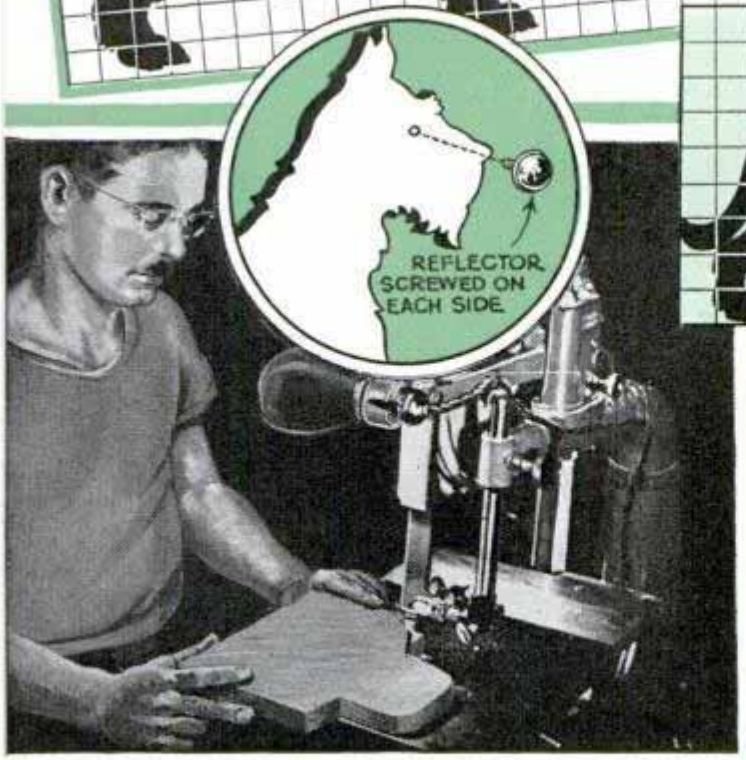
These WOODEN DOGS carry parkway numbers

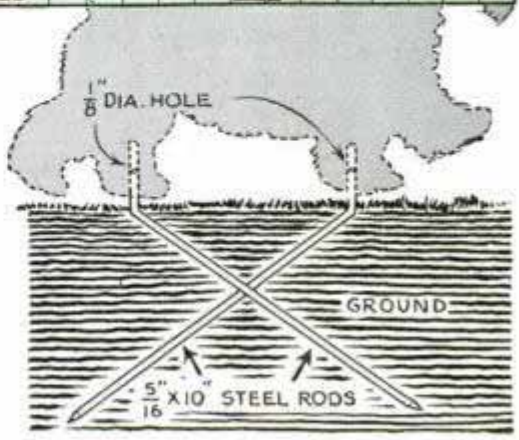
SET in a parkway, on your lawn or at the curb, the Scottie-dog cutout at the right, with its sparkling eyes, jauntily poses your house number in plain view. The cutout can be sawed to represent any animal or pet if those given below do not suit. Cut it from 1⅛-in. selected white pine and paint in appropriate colors. Reflector-type bolts used for car licenses serve as eyes and reflect the light from passing cars. The numbers are sawed from ¼-in. white pine and bradded to each side of the cutout.





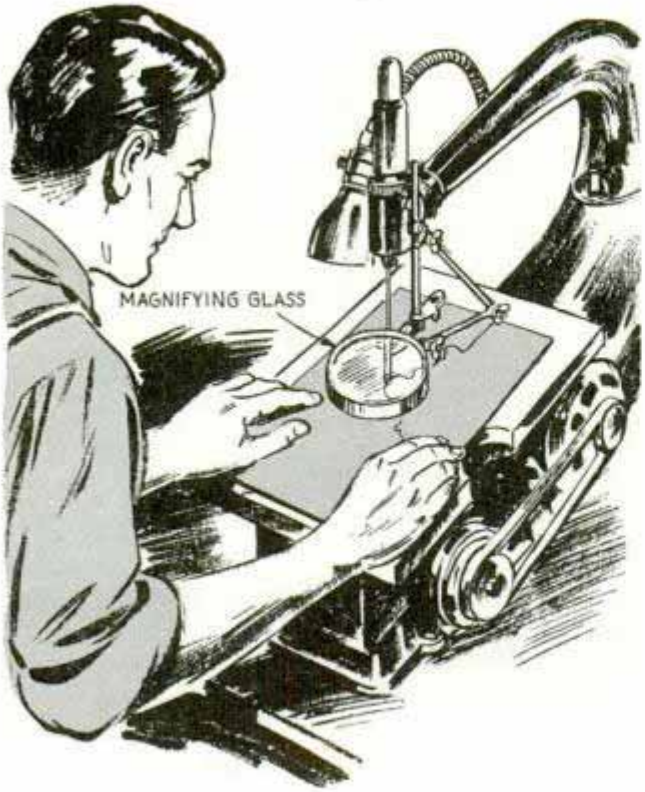






There is little possibility of theft if you mount the cutout on rods driven deeply into the ground as above. Drive screws into the side of the feet to fit into holes near the rod ends and then file the heads so that they cannot be removed with a screwdriver

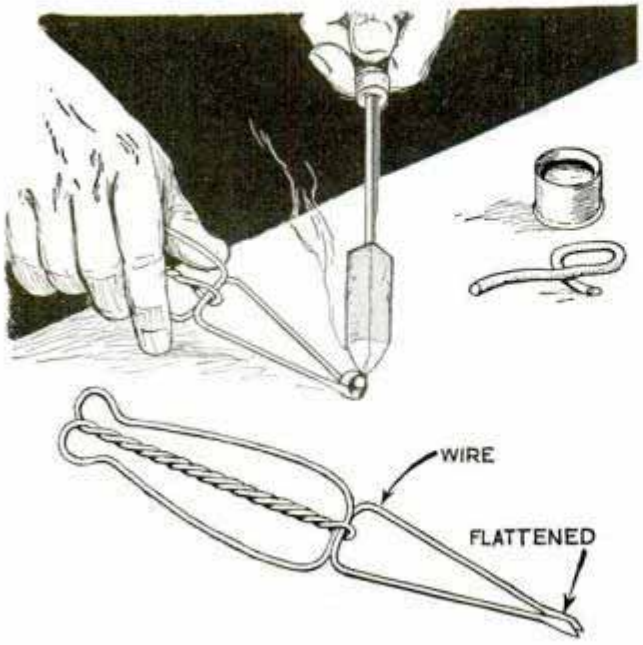
Magnifying Glass on the Jig Saw Aids When Doing Fine Work



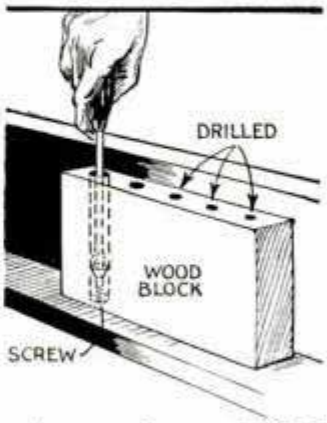
You will find a magnifying glass helpful when doing fine work on a jig saw. A reading glass is just the thing for the purpose, and the handle can be clamped to the machine to hold the glass in position.

Wire Tongs Hold Small Parts While Soldering

Made by bending a length of wire to the shape shown, this pair of tongs are handy for holding small parts while soldering them. Also, they are convenient for removing small objects from a sterilizer and similar places, and you will find them very useful for picking up articles that are too small to get easily with the fingers.—S. B. Quackenbush, W. Los Angeles, Calif.



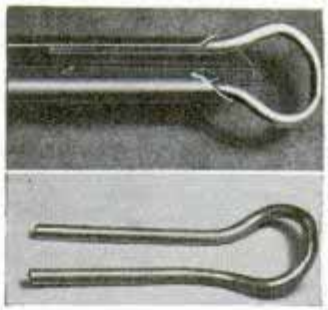
Drilled Block to Drive Screws in Tight Places



As a guide in starting screws in wood, you will find this block just the thing, especially in tight places where it is impossible to drill a small pilot hole to start the screw. The block is hardwood, and has several holes of various sizes drilled through it to fit different screws. The holes are of a size to take the screw heads with a snug, sliding fit.

—James F. Ferguson, Oregon, Ill.

Shield on End of Curtain Rod Prevents Snagging the Hem



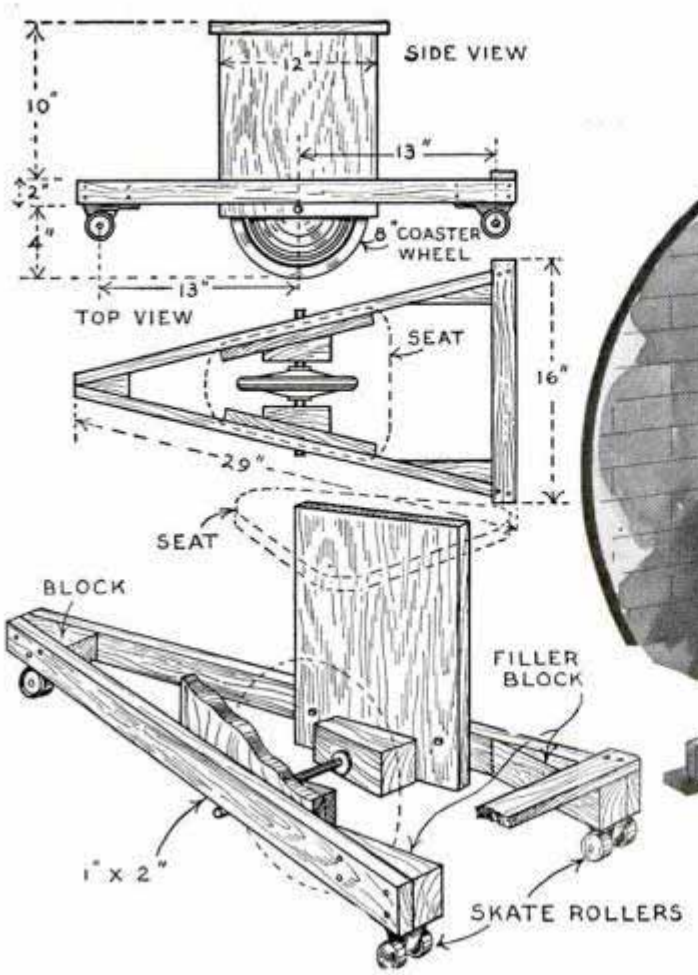
Bent as indicated and inserted into the end of a curtain rod, a piece of wire solder provides a good shield to prevent tearing the curtain hem when inserting the rod. Wire solder is better for this purpose than wire because it is easy to bend yet is stiff enough to hold its shape.

—Arthur Trauffer, Davenport, Ia.

Spring Paper Clip Grips Nails to Start Them

To hold slender wire nails while driving them, a spring paper clip will be found useful. Besides protecting the fingers, the clip tends to prevent the nails from bending.

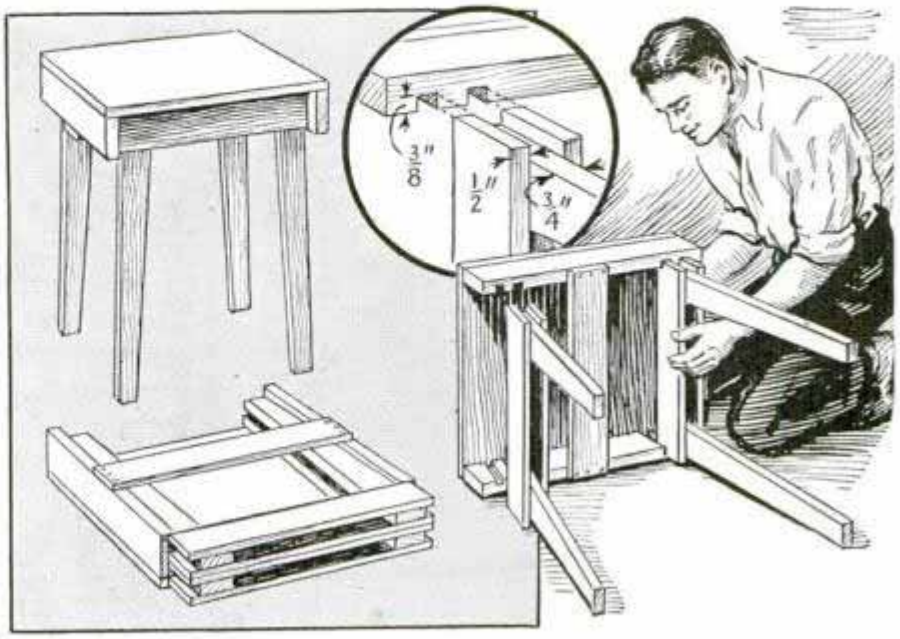
Learn to Balance on This Monowheel Cart



After you have adjusted your weight for proper balance on this novel one-wheel coaster, it will still be a trick to maintain that balance while coasting. While essentially a one-wheel affair, the triangular frame is fitted at each corner with a set of roller-skate wheels, which prevent sudden stops and spills in case the rider tips over too far forward, backward or sideways. When the frame is horizontal, the sets of skate rollers should clear the sidewalk by about 2 in. Beginners can start by riding the main wheel and the two rear sets of skate wheels. With a little practice enough skill can be developed to balance on the large center wheel alone.

Collapsible Picnic Table Takes Little Space in Your Car

On this table cross rails on the legs slide into grooves in the side rails, an arrangement which permits quick dismantling yet provides sturdy support when the table is set up. For carrying or stowing the table in a small space, both pairs of legs are pushed between the top and a crosspiece attached to the side rails. In this position all three of the units comprising the table are held together securely.



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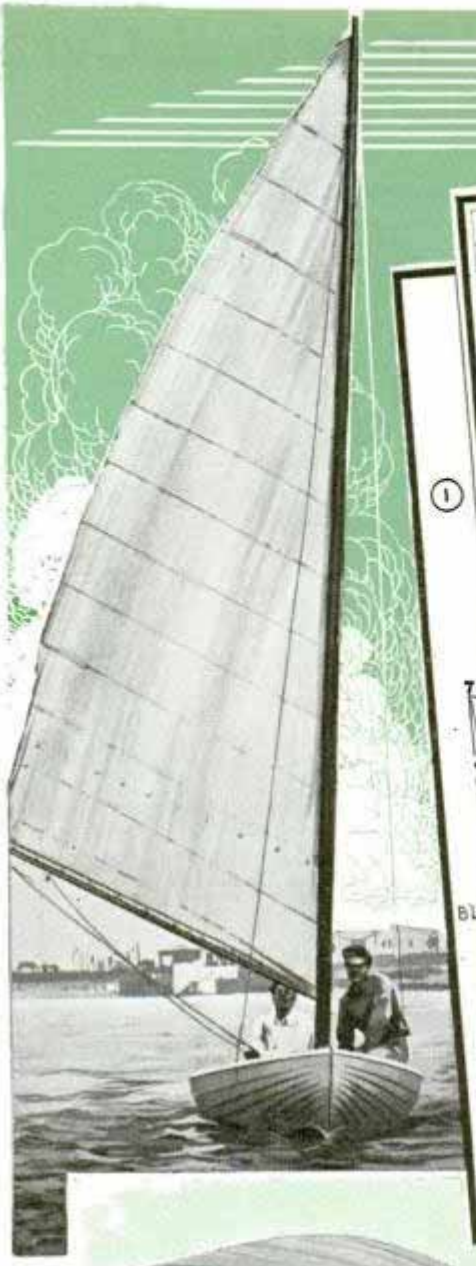


TABLE OF OFFSETS

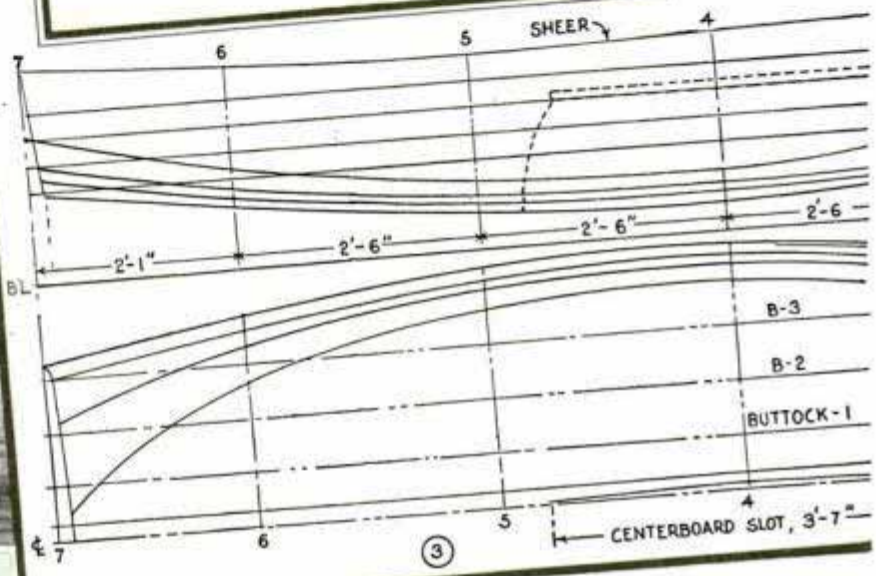
Dimensions in Feet—Inches—Eighths-inches

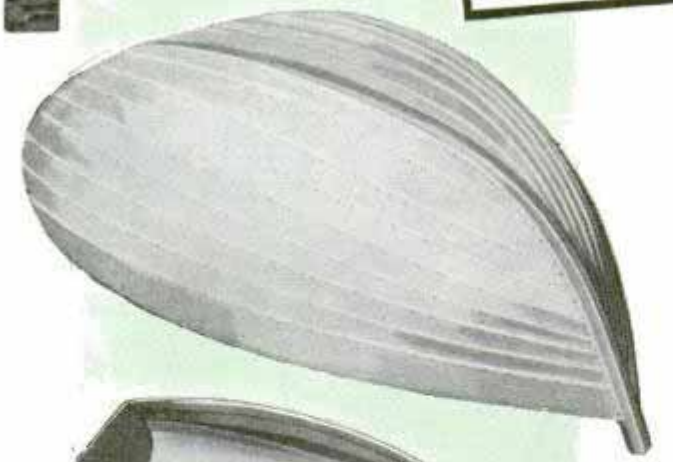
HEIGHTS ABOVE BASELINE

Station	1	2	3	4	5	6	7
Sheer	2-11-1	2-8-5	2-6-2	2-4-3	2-3-5	2-4-1	2-5-5
Buttock 1	1-5-4	0-10-7	0-8-0 +	0-7-2	0-8-2	0-11-1	1-3-2
B—2	—	1-3-0	0-9-6 +	0-8-2	0-9-2	1-0-2	1-4-7 +
B—3	—	—	1-2-1	0-10-2	0-10-7	1-2-7	1-9-2
Rabbet	1-0-2	0-9-3	0-7-2	0-6-5 +	0-7-5	0-10-2	1-2-2
Keel	0-11-0	0-8-5	0-6-7	0-6-2 +	0-7-2	0-9-7	1-1-0 +

HALF-BREADTHS

Sheer	0-10-7	1-7-7	2-3-1	2-6-6 +	2-6-3	2-3-1	1-10-0
WL—1	0-3-4	1-0-1	1-8-4	2-2-1	2-2-1	1-6-2	—
WL—2	0-6-3 +	1-3-4	1-11-4	2-4-4 +	2-4-6	1-11-5	1-2-3
WL—3	0-8-3	1-5-3 +	1-11-3	2-6-0	2-6-0	2-2-2	1-8-5
WL—4	0-9-3	1-6-5	2-2-2	2-6-4	2-6-3	2-3-0	1-9-6





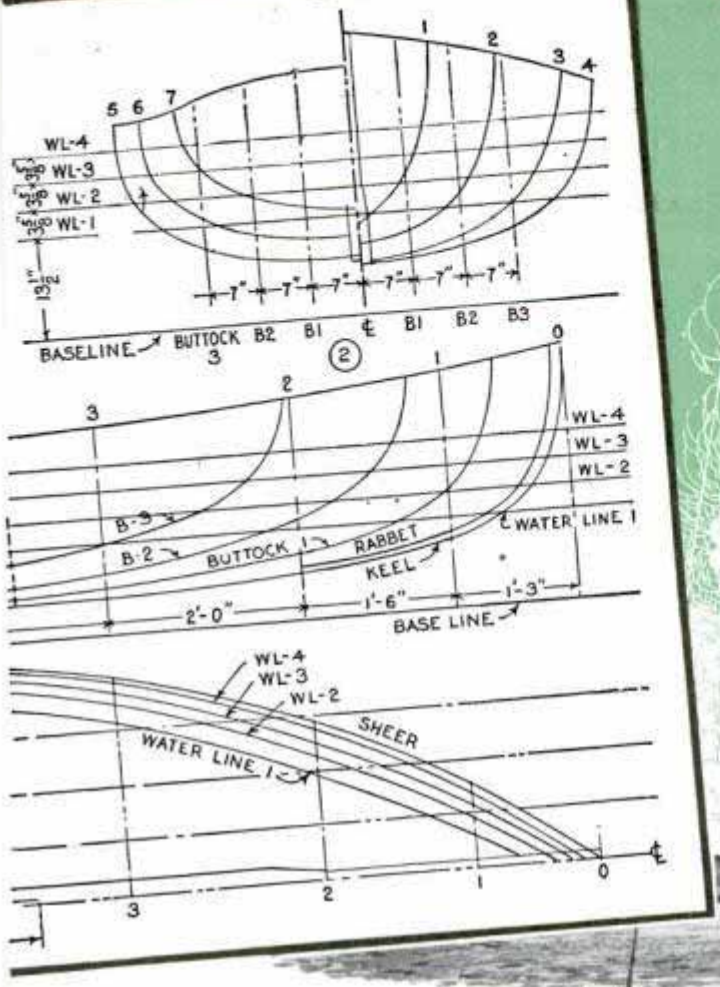
By CHAS. H. McALARY

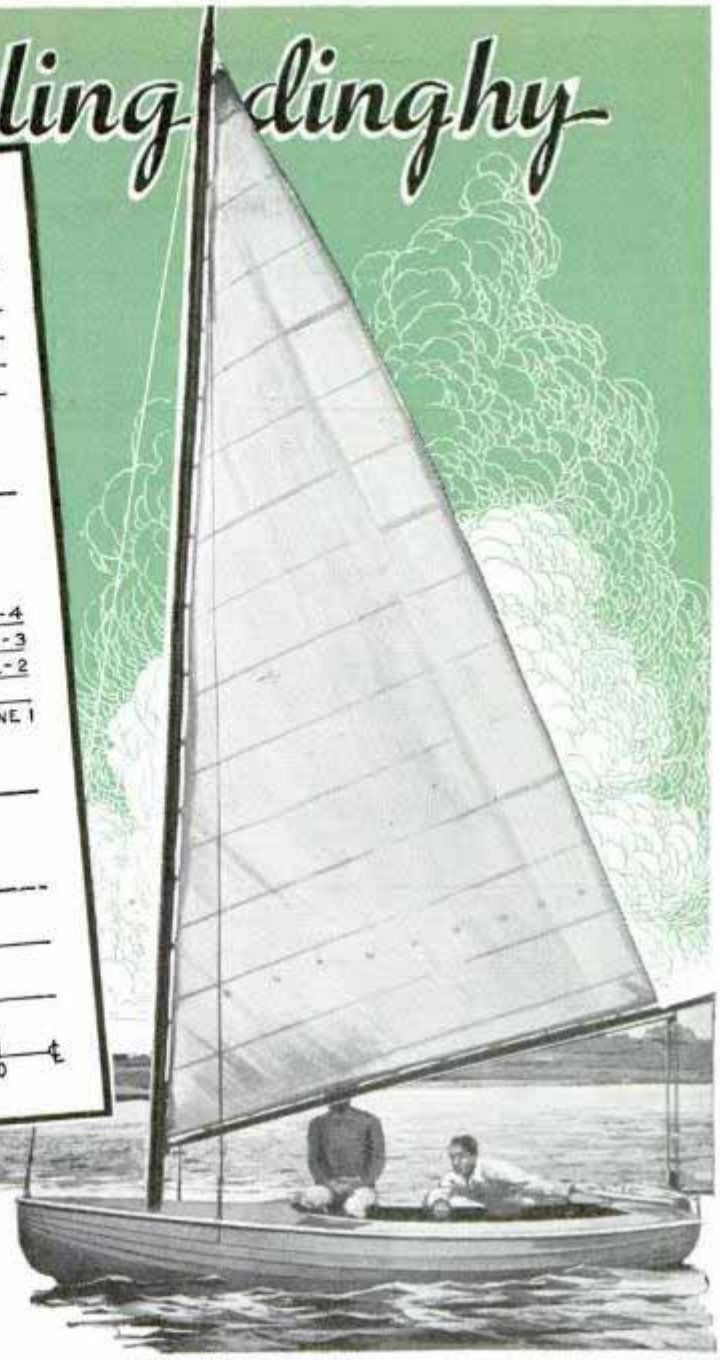
Part I—Building the Hull

THIS fleet 14-ft. boat combines strength with light weight, and is easily maneuvered. It carries 140 sq. ft. of canvas and weighs about 350 lbs. Approximate cost of materials, including sail, steel centerboard, hardware and rigging is $125 to $150, according to location.

A table of offsets, Fig. 1, enables you to lay out exact patterns for temporary frames, on which the boat is built. The patterns for the frames are drawn on heavy paper ruled off in 1 or 2-in. squares as in Fig. 9. Dimensions in the table of offsets are from the centerline and baseline to the outside of the planked boat. Therefore the curves for the frames should be drawn ⅜ in. inside of the curves obtained from the table of offsets, as the planking used on this boat

a 14-ft. sailing dinghy



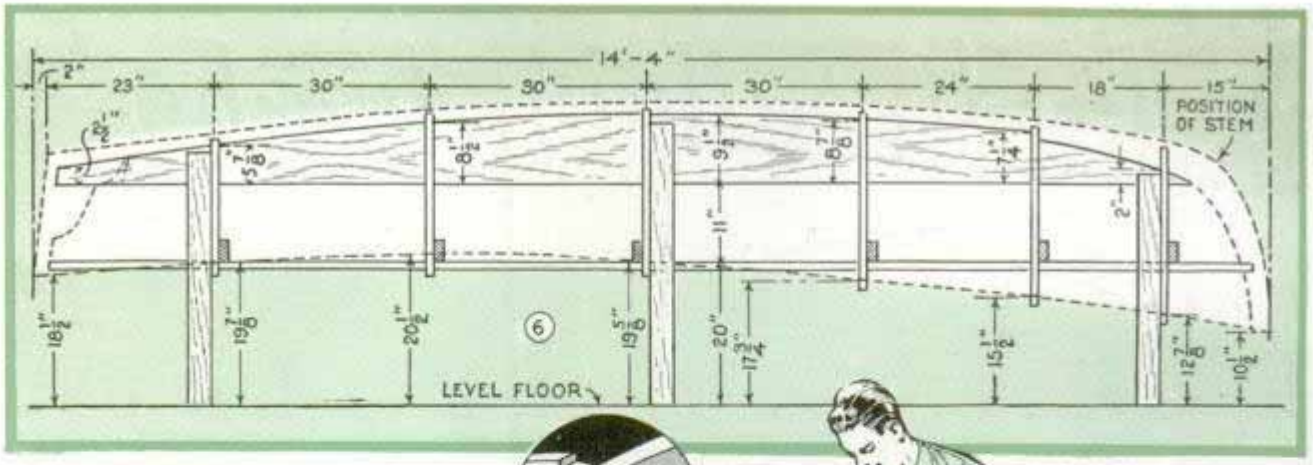


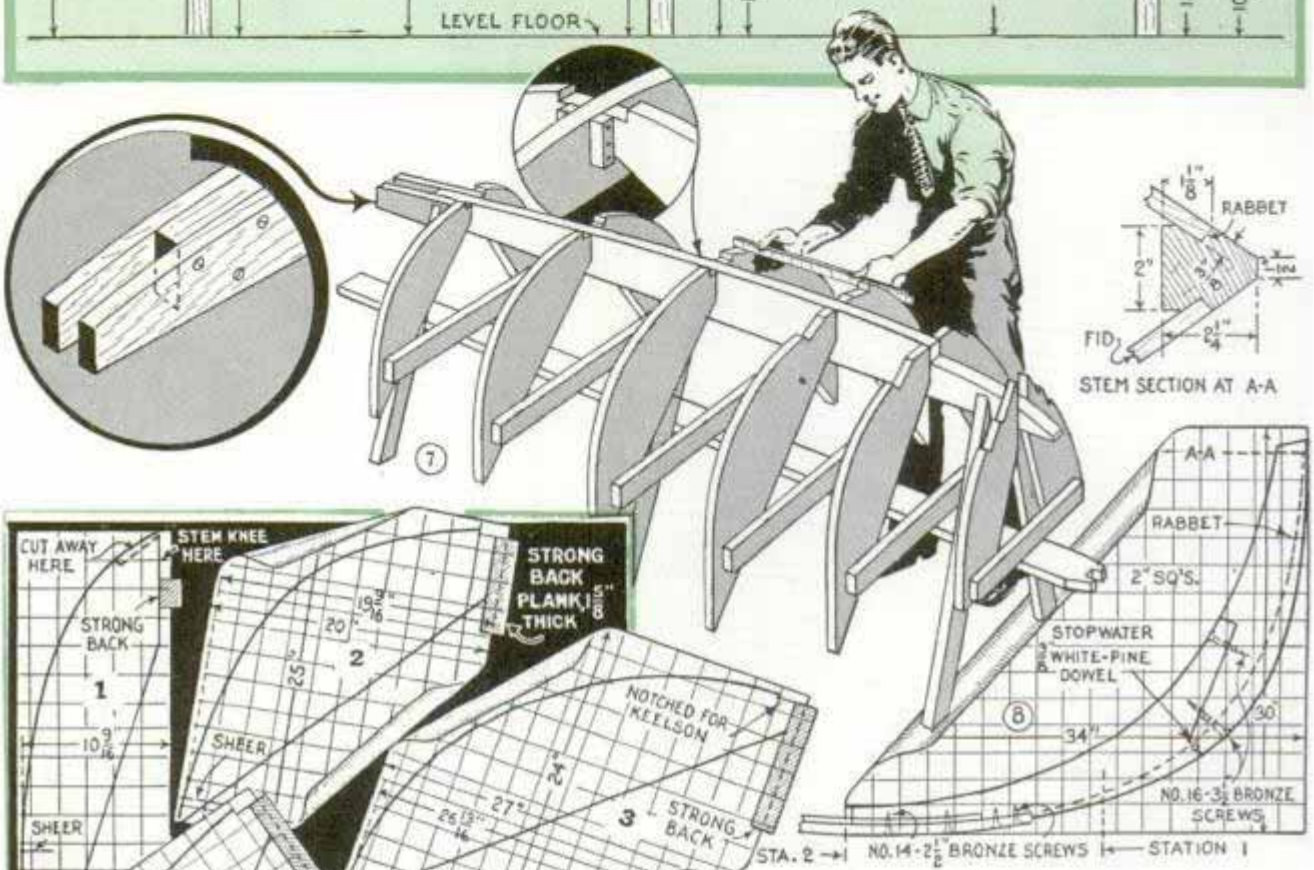
is ⅜ in. thick. Fig. 9 shows how the patterns for the frames are drawn, but the curves should not be drawn from these sketches, as they will not give the accurate results that you will get by laying them out from the table of offsets. From Figs. 1, 2 and 3, you will be able to locate the points along which the curves are drawn.

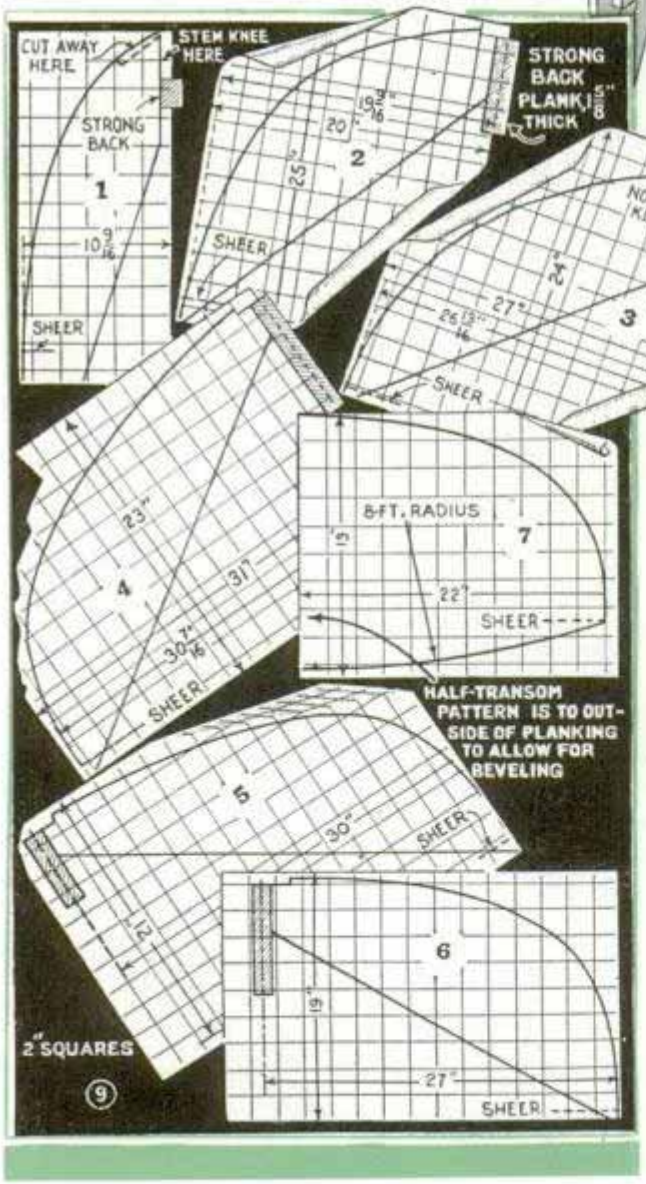
After cutting the frames from wide pieces of 1-in. soft pine, assemble them on a strongback as in Figs. 6 and 7. This is a 2-in. plank (about 1⅝ in. dressed), one edge of which is cut to the curvature of the keel. The front end of the strongback is cut away to receive the stem knee, and the transom knee fits between two pieces at the after end. A board runs below the strongback, and is notched for the stem. Bevel the edges of the frames to conform with the curvature of the hull. The bevel is determined by testing with a straight batten about ½ in. thick. In building any boat the frames must be so beveled or "faired off"—that is, planed to a natural curve. If one frame has a hump so that

ZEPHYR

Length overall	**14 ft. 4 in.**
Length at waterline	**13 ft. 8 in.**
Beam	**5 ft. 2 in.**
Draft	**7 in.**
Freeboard for'd.	**2 ft. 0 in.**
Freeboard aft	**1 ft. 4 in.**



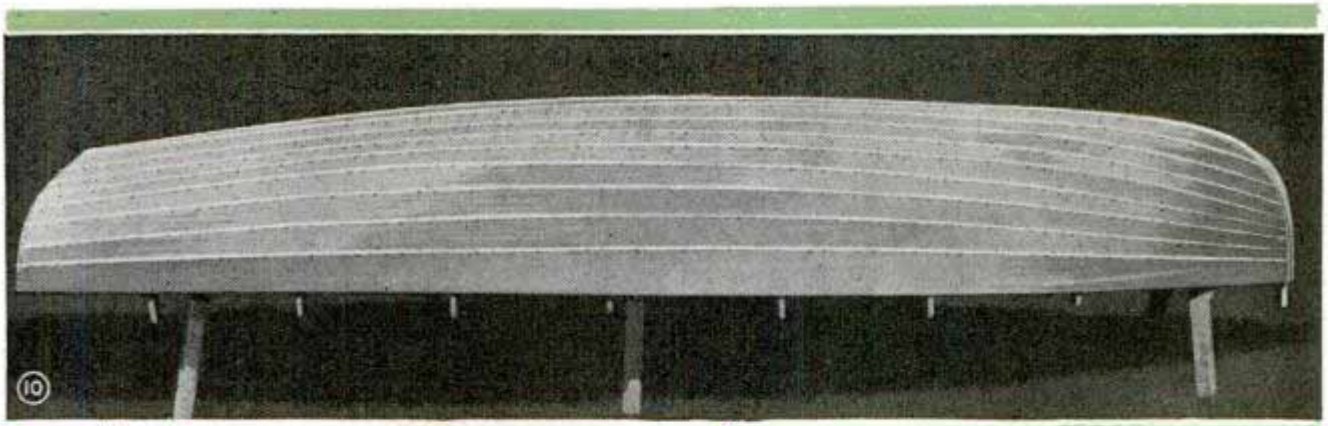


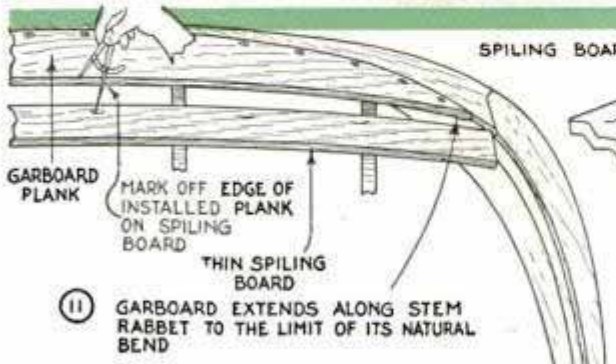


the batten does not touch the adjoining frames, fair the offending member down.

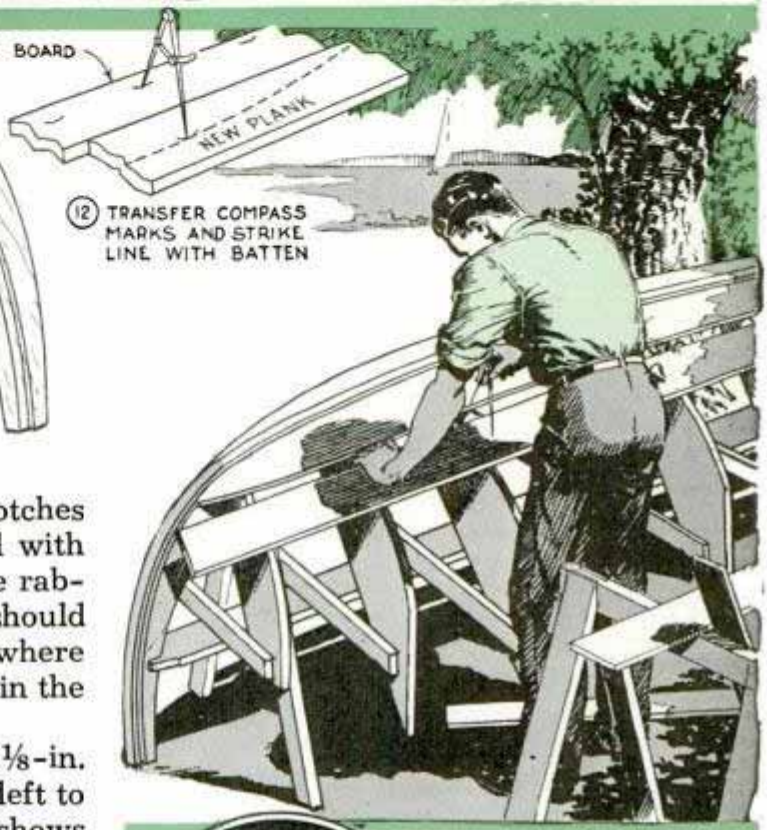
Each pair of frames is notched for the ½ by 4-in. keelson. At the forward ends, where the planks will have a pronounced bend, it may be necessary to notch or flatten the frame for a plank or two, but this should be done after the garboard (plank next to the keel) and adjoining plank have been laid out.

The stem, Fig. 8, is bandsawed from 2-in. mahogany or white oak, and is assembled with the knee. Fit the joint between stem and knee tightly, using a clamp as in Fig. 5. Then drill a ⅜-in. hole for a stopwater, or white-pine dowel, which will swell with moisture and make a watertight joint. Also apply marine glue to the contacting surfaces. The rabbet for the planking is marked out but not tested until the stem is on the assembling frame. Then a stick





(11) GARBOARD EXTENDS ALONG STEM RABBET TO THE LIMIT OF ITS NATURAL BEND



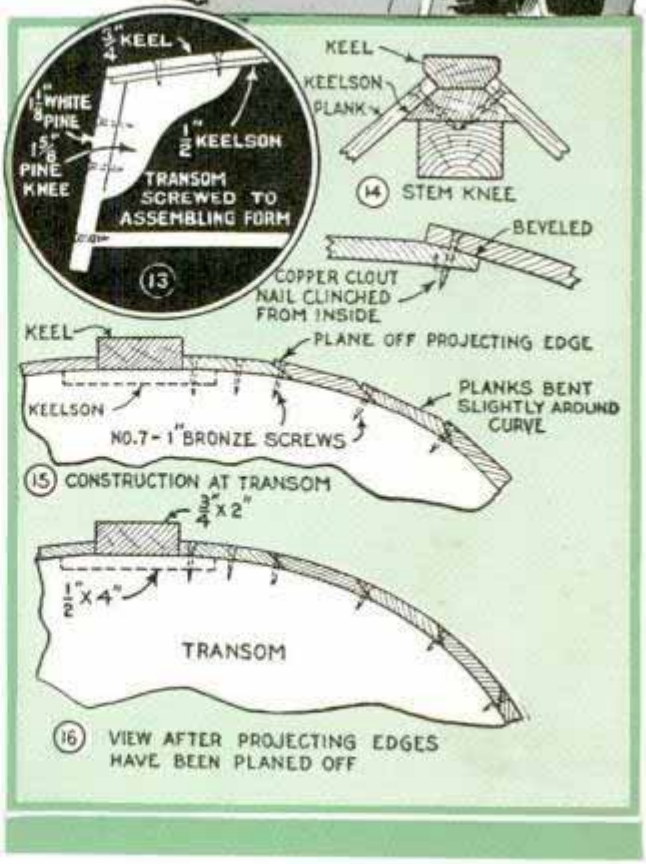
(12) TRANSFER COMPASS MARKS AND STRIKE LINE WITH BATTEN

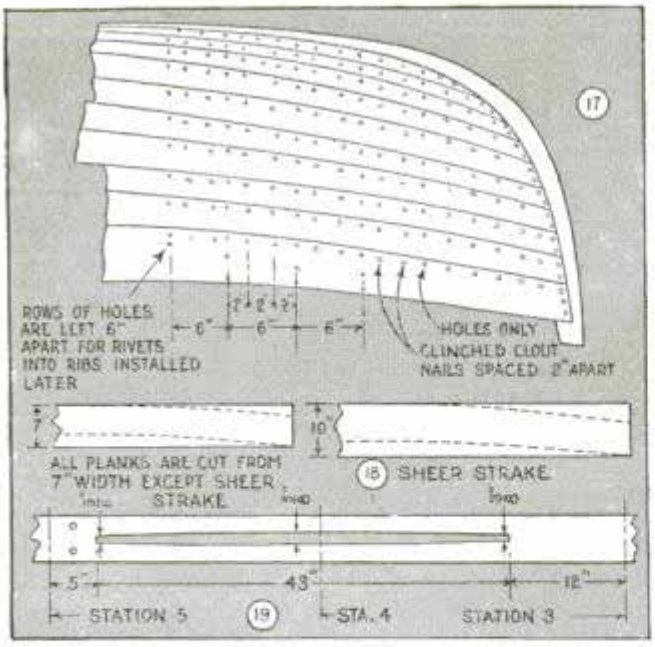
is placed against frame No. 1 and into notches along the line of the rabbet to be sure the right angle is achieved. When several of these notches about 4 in. apart are cut and tested with the fid, or stick, the remainder of the rabbet may be chiseled out. The planks should lie perfectly flat against the stem where they fit into the rabbet as illustrated in the upper detail of Fig. 8.

The transom is bandsawed from 1⅛-in. white pine. Enough stock should be left to allow for the bevel edges. Fig. 13 shows how transom and stem are assembled to the keel and keelson. Marine glue or white lead should be applied to contacting surfaces. The keelson is notched into the transom. A screw through the forward end of the strongback temporarily secures the stem-knee to the frame while fitting and assembling.

The centerboard slot is cut between stations 3 and 5, Fig. 19. It is wider in the middle than at the ends. This prevents the steel centerboard from being pinched when the wood swells. For amateur sailors, a ⅜-in. centerboard is advised, as the extra weight provides more ballast than one 3/16 in. thick. The centerboard slot and well are varied accordingly. Dimensions given in this article are intended for a 3/16-in. centerboard but if you change to a ⅜-in. thickness be sure to increase the space to accommodate it (3/16 in. wider slot than given in the drawings).

Screws through keelson to keel are





placed on each side of the slot. Elsewhere the screws run along the centerline of the keel. These screws should be spaced so they will not interfere with other screws through the ribs to be installed after the entire hull is planked and has been removed from the form. The ribs are to be spaced 6 in. on centers, beginning at the bottom of the transom.

Now for planking. The garboard, or plank alongside the keel comes first. The shape of this can be laid out with a spiling board, as in Figs. 11 and 12. Bring the plank as far forward on the stem-knee as possible without twisting or straining unduly. A mistake many amateurs make is in not doing this, with the result that all following planks must assume a pronounced curve. When the plank is fitted so that it lies snugly against keel and in the stem rabbet, remove and apply marine glue. This is applied along keelson, keel and stem rabbet, and then the plank is drawn down with No. 6, ¾-in. bronze wood screws, heads countersunk just enough to putty over later. Install one garboard, then the other, and proceed in this manner through the entire planking job. If planks are all screwed down on one side before beginning the other, it imposes a strain which might pull the hull out of shape.

With garboards installed, spile for adjoining planks. They are lapped ¾ in., Fig. 14. The edge of the garboard is beveled where the succeeding plank laps over it. Mark the garboard where the next plank should come. Apply marine glue and drill holes 2 in. apart for copper clout nails, which should be a snug fit. The ends are placed on an iron bar and bent back into the wood. Amidships the curve of the frames is not so pronounced and the garboard lies flat on the keelson. Near the stem, however, the keelson as well as keel is beveled along the rabbet, becoming more pronounced near the rabbet in the stem. As the planks approach the transom and stem, the overlap gradually disappears into a beveled butt joint as shown in Figs. 15 and 16. Some builders flatten the rounded profile of the transom to take care of the flat plank ends, but a nicely rounded effect can be achieved on this hull simply by trimming out the underside of the plank end slightly concave. This permits the plank to fit more closely to the edge of the transom, and with very slight bending will follow the curve of the latter. Take plenty of time and be accurate as watertight qualities of a hull depend upon this work.

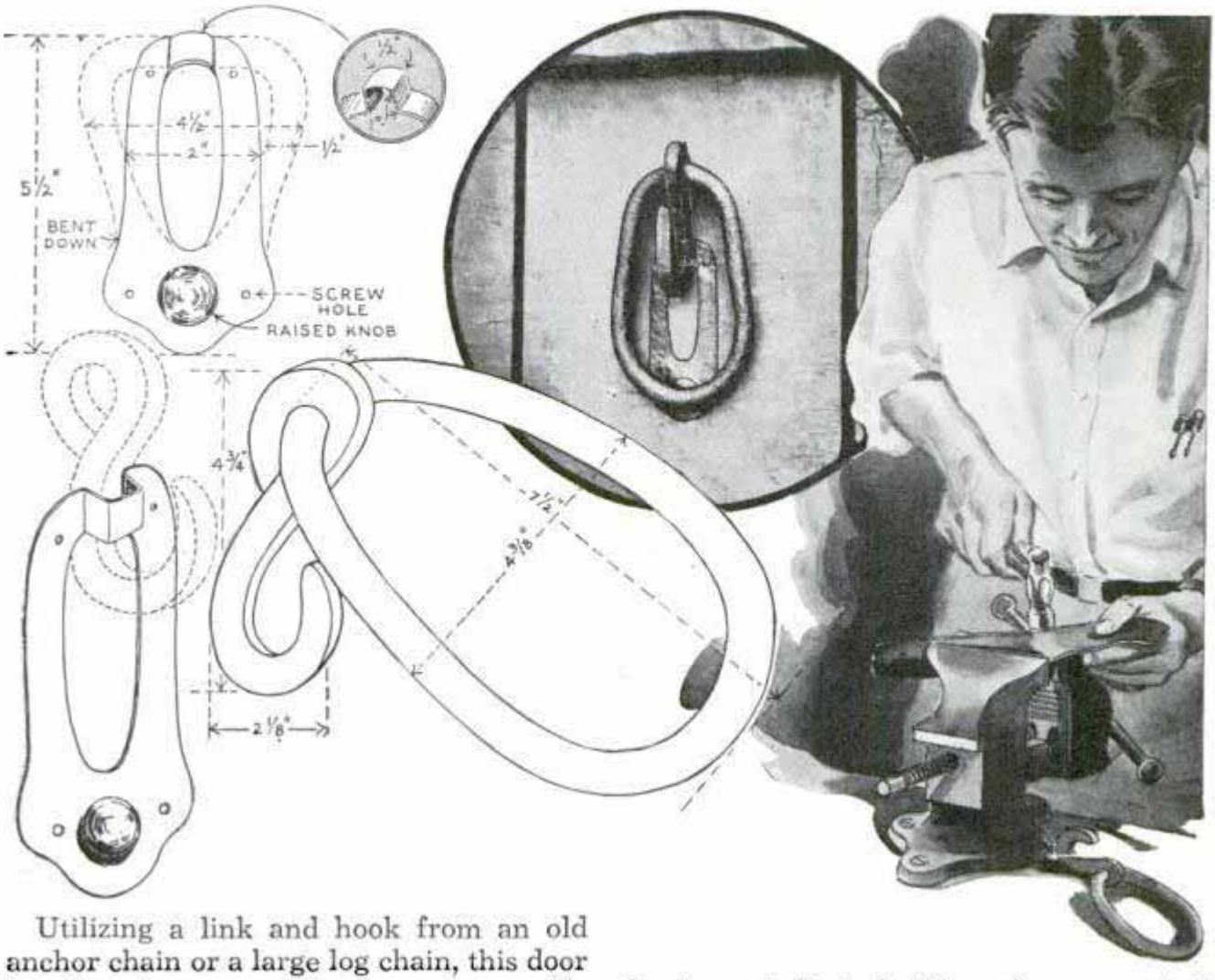
Note the pleasing, gentle curve of the sheer strake from Fig. 18. In drilling the holes for the clout nails 2 in. apart as in Fig. 17, leave them out every 6 in. for rib rivets. The completed hull, Figs. 4 and 10, may now be lifted off the form. The inside is painted before installing the ribs, which will be described in the next installment.

BILL OF MATERIALS

All dimensions net—does not include stock for temporary frames and strongback

1 pc. 2 x 8 in. x 4 ft.—mahogany or oak for Stem
1 pc. ½ x 4 in. x 14 ft.—pine or oak for Keelson
1 pc. ¾ x 2 in. x 14 ft.—oak for Keel
1 pc. 1⅛ x 17 in. x 4 ft.—white pine for Transom
1 pc. 1⅛ x 14 in. x 4 ft.—white pine for C-board box
16 pcs. ⅜ x 7 in. x 16 ft.—vertical grain spruce for Planking
2 pcs. ⅜ x 10 in. x 16 ft.—vertical grain, spruce for Planking (Sheer Strakes)
27 pcs. ⅜ x ⅞ in x 8 ft.—oak for Bent frames
1 pc. ⅞ x 12 in. x 18 ft.—pine for Deck beams
2 pcs. ¼ x 48 in. x 8 ft.—waterproof plywood for Deck
2 pcs. 1¼ in. x 16 ft. half-round—mahogany for Rub rails
1 pc. 1¼ in. x 4 ft. half-round—mahogany for Transom molding
1 pc. ⅞ x 10 in. x 5½ ft.—pine for Seat
1 pc. ½ x 4 in. x 16 ft.—mahogany for Coaming
1 pc. 3 x 3 in. x 28 ft.—spruce for Mast
1 pc. No. 10, 6 x 15 ft.—canvas for Deck
11 pcs. ⅜ x 2½ in. x 8 ft.—white pine or spruce for Floor boards
1 pc. 3/16 to ⅜ x 18 x 50 in. boiler plate, galvanized for Centerboard (see text for thickness of centerboard)
Bronze or galvanized hardware, screws, Marine glue, candlewicking, paint, putty, etc.

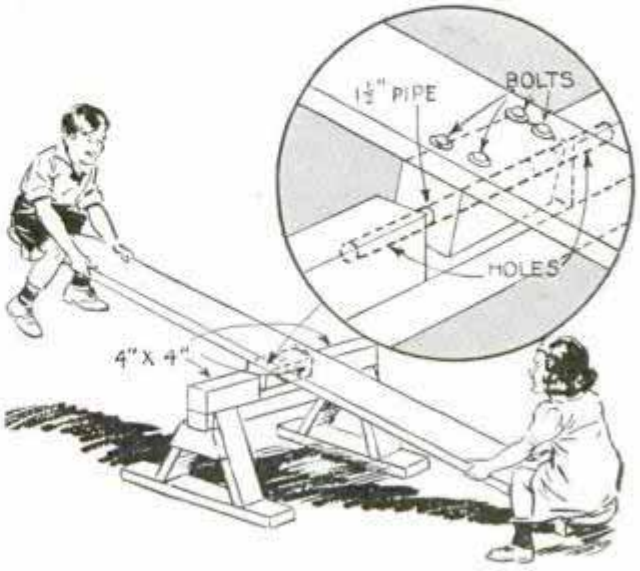
Rustic Door Knocker Made from Chain Parts



Utilizing a link and hook from an old anchor chain or a large log chain, this door knocker is appropriate for your seaside cottage, summer camp or even your home. The hook and link require no shaping or finishing. Just cut a backing plate from soft sheet metal on which to mount them. File and hammer the plate to shape, forming a small loop at one end to fit over the hook as indicated. Then form a raised knob in the center of the lower end for the link or knocker to strike against. Drill four holes through the plate and attach it to the door with round-headed screws. Complete the job by coating the knocker with a dead-black paint.

Portable Seesaw with Wooden Bearings Operates Easily

As this seesaw is portable it can be moved to any desired location in the yard. Its construction is rugged and it pivots on wooden bearings. To make it, first assemble a strong sawhorse for the support, mounting the legs on planks to prevent sinking into the ground. Then bore a hole lengthwise through a 4 by 4-in. block to take a length of 1½-in. pipe snugly. The pipe should extend 3 or 4 in. at each end of the block to fit in other blocks bolted to the top of the sawhorse as indicated. Facing ends of these are bored and filled with grease to serve as bearings for the pipe. Bolting a long plank to the pivoted block completes the job.

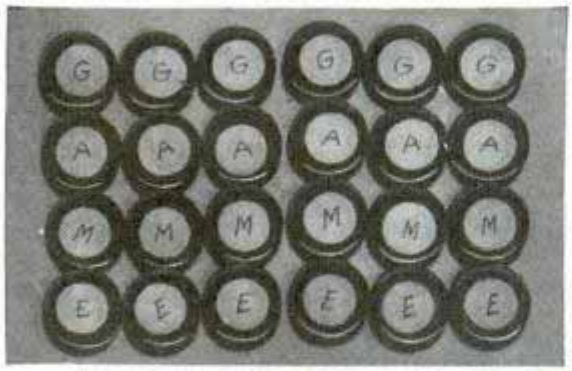


Fishing Reel Stores Extra Cord for Household Use

Conveniently located inside a cupboard, an old fishing reel is handy to store twine for use around the home. When a package from the store is unwrapped, just save the string, tie it to the end of that already on the reel, and wind it up.

Variation of Checker Game Is Novel Pastime

If you like to play checkers, you will enjoy this variation of the game as it presents an entirely different method of play to gain the desired objective. To prepare the checkers, glue white-paper disks to them and letter as shown in the upper photo. The regular rules of checkers apply to this variation, and the moves are made in the same way. The objective of the game is not as in ordinary checkers, to eliminate the opponent's men until none are left, but to place four of yours in the opponent's king row in sequence to spell the word "game" as read from your end of the board. If you succeed in this, you win. It is important, while trying to make this sequence, that you do not allow your opponent to capture all three of your men of one letter. If this does happen, however, your objective then is to attempt to take three of a kind from your opponent, or to block him so that he cannot form the word in your king row.

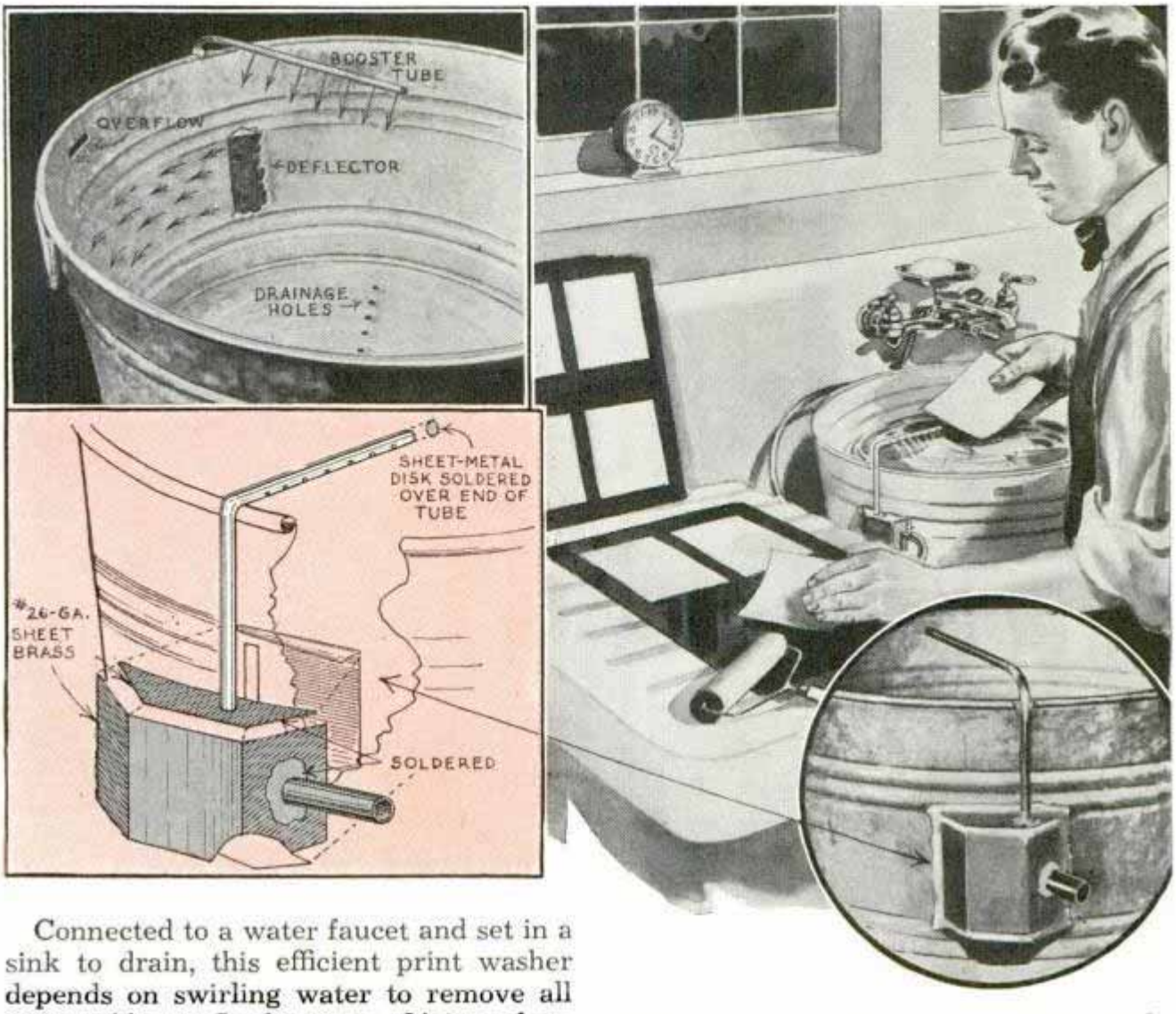


Mailbox Standard Swings to Pass Road-Maintenance Machinery

Having his mailbox either tipped over or the standard broken off by snowplows and other road-maintenance machinery, one farmer used the standard shown to avoid this trouble. It sets well back from the edge of the pavement yet supports the box close to the pavement for convenience of the mail carrier. If a machine strikes the box, it swings to one side and comes back into position when the machine has passed. The standard keeps the box facing the road under ordinary strains such as wind, etc.

—Walter L. Andre, Cornell, Wis.

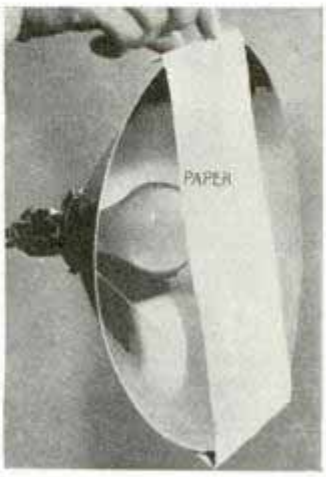
Efficient Print Washer from Ordinary Tub



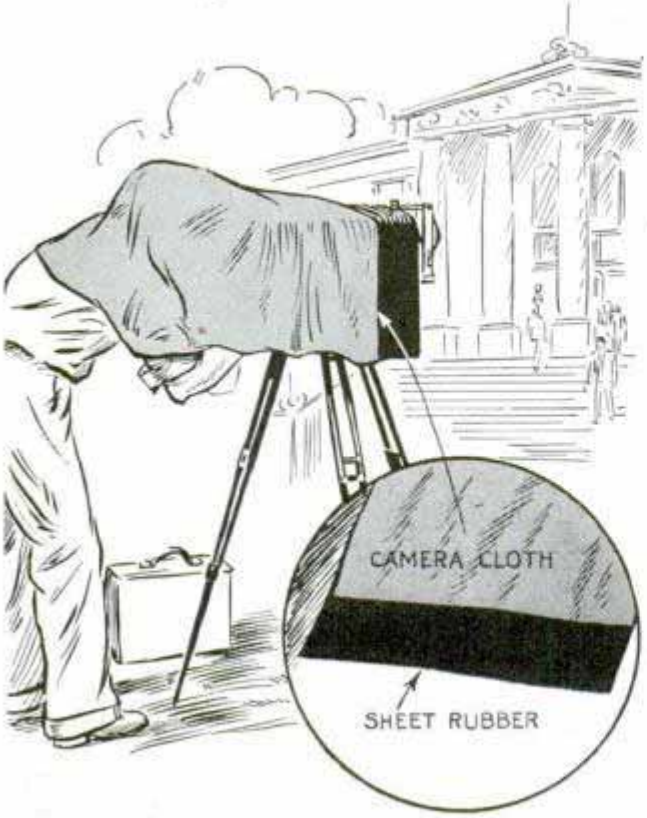
Connected to a water faucet and set in a sink to drain, this efficient print washer depends on swirling water to remove all traces of hypo. In this case a 24-in. galvanized washtub was used, which handles a dozen prints at the same time and removes all traces of hypo in about an hour's time. However, the same principle can be applied on smaller tubs. A rubber tube is connected from the faucet to a water jacket soldered on the outside. From this point water enters through a narrow slot over which a deflector is soldered, this being closed on three sides. The space between the deflector and the wall of the tank is about 1/32 in., which directs water in the direction shown by the arrows. The width of the slot can be varied to control the pressure of water issuing from it and to control the pressure of the water ejected from the booster tube on the surface of the water, which keeps prints separated and submerged. The booster tube is a length of 5/16-in. copper tubing soldered to the water jacket, closed at the other end and having a number of 1/32-in. holes 1/2 in. apart to direct small jets of water downward at an angle of about 45 degrees in the same direction as the flow in the tank. The end of the tube is not directly over the center of the tank but about 4 in. back of the center, which prevents prints from being "kicked" against the side. Drainage is provided by overflow slots near the top, and 1/16-in. holes drilled through the bottom.

Paper Strip Diffuses Floodlight

Diffused light can be secured from an ordinary photoflood reflector by fastening a strip of thin paper to the reflector directly in front of the bulb. The strip should be about 4 in. wide and can be held in place with paper clips.



Strip of Rubber on Focusing Cloth Clings to the Camera



Focusing is made easier, especially outdoors in the wind, if a wide strip of rubber sheeting is cemented along one edge of the focusing cloth. The rubber clings to the wood or leather parts of the camera and will not slip off easily. Use rubber cement to fasten the rubber strip to the cloth.

Two Towel Holders in Darkroom Made from One Shoe Tree

One shoe tree will provide two handy towel holders for your darkroom. Held by pressure of the wood parts of the tree, the towels can be removed and replaced quickly, and there are no hooks to damage the cloth. For greatest convenience, several holders can be located around the darkroom. After cutting the spring of the shoe tree in the center, file small notches near the end of each half to take the screws as shown in the photograph. It is much easier to file these notches than to attempt to drill a hole in the hardened spring.

Simplified Test for Wash Water Indicates Presence of Hypo

A drop of strong potassium permanganate solution in the washing tank will show whether or not prints or negatives have been washed sufficiently. The potassium permanganate will turn the water a brilliant purple, but should any hypo be present the color will fade quickly to a dirty orange or yellow. This treatment is harmless to prints or negatives.

—Kenneth Murray, Colon, Mich.

Paper Clips Provide Finger Grips to Handle Photo Film

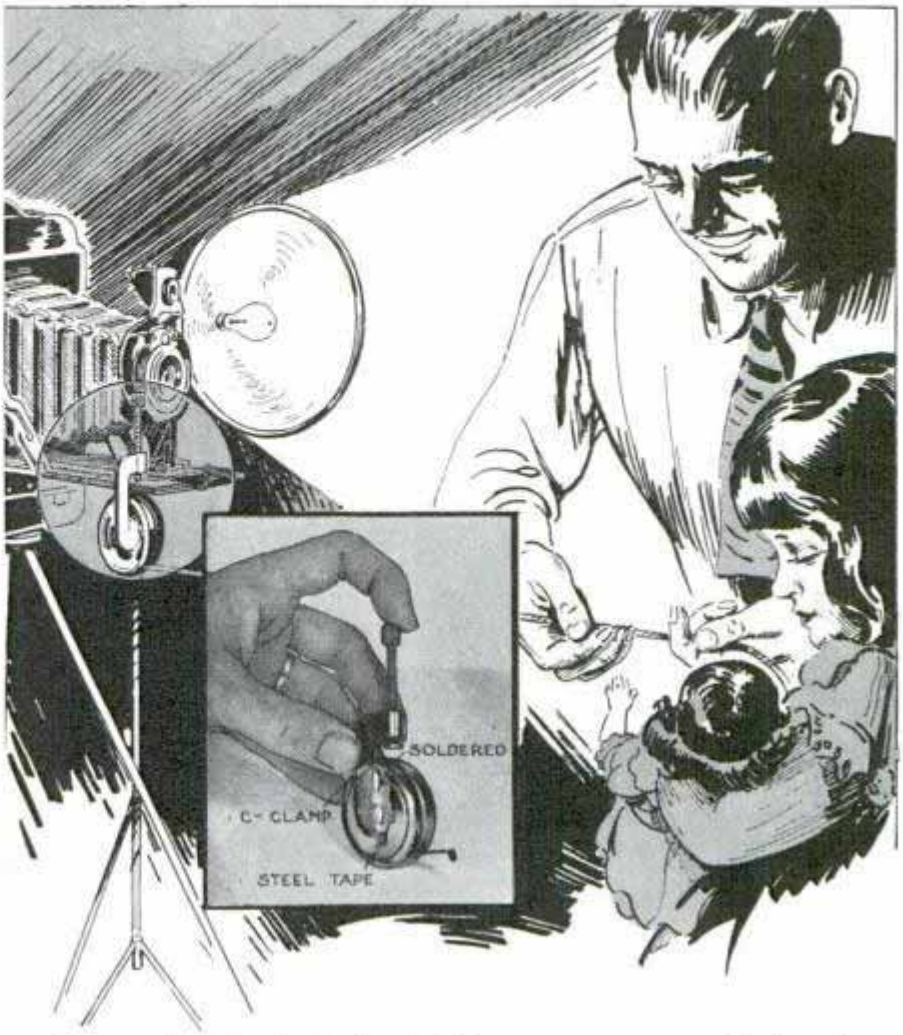
Amateur photographers who employ the "seesaw" method of developing films are often annoyed by the difficulty of holding the slippery ends with the fingertips. If brass paper clips, of the type shown, are attached to each end of the film they will serve as grips to facilitate the work. If a number of films are to be developed at the same time, and there is need of identifying them, the clips may be attached to each one in a slightly different position.

Two-Solution Developing Method Is Fast and Sure

Called automatic because over or underdevelopment cannot occur, this system of film developing is much faster than the usual method. It is especially suited to roll film and is not difficult to carry out. Two solutions are used. To make Solution I, mix the following chemicals in the order

named in 24 oz. of water at 110° F.: metol, 5 grams; sodium sulphite (anhydrous), 3½ oz.; glycin, 5 grams. Then add water to make 32 oz. Solution II consists of sodium carbonate, 3½ oz., dissolved in warm water, 24 oz., with cool water added to make 32 oz. Store the solutions in brown bottles. Immerse the film in Solution I for 30 to 45 seconds (30 seconds for slow and normal-speed films and 45 seconds for the ultra-speed films). Allow the film to drain for 5 seconds, then immerse in Solution II for 1 minute. Agitate the film while it is in the solutions. Rinsing, fixing and washing are carried out in the usual way. The activating agent (Solution II) oxidizes only the developing agents (Solution I) that have been absorbed by the emulsion and development, then stops automatically. Thus a film that has been given approximately the correct exposure will produce a perfect negative.—Cliff Edwards, Oshkosh, Wis.

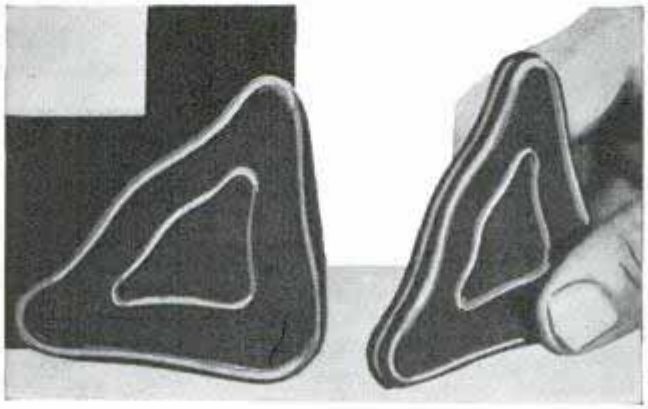
Steel Tape Clamped on Camera Checks the Distance for Portraits



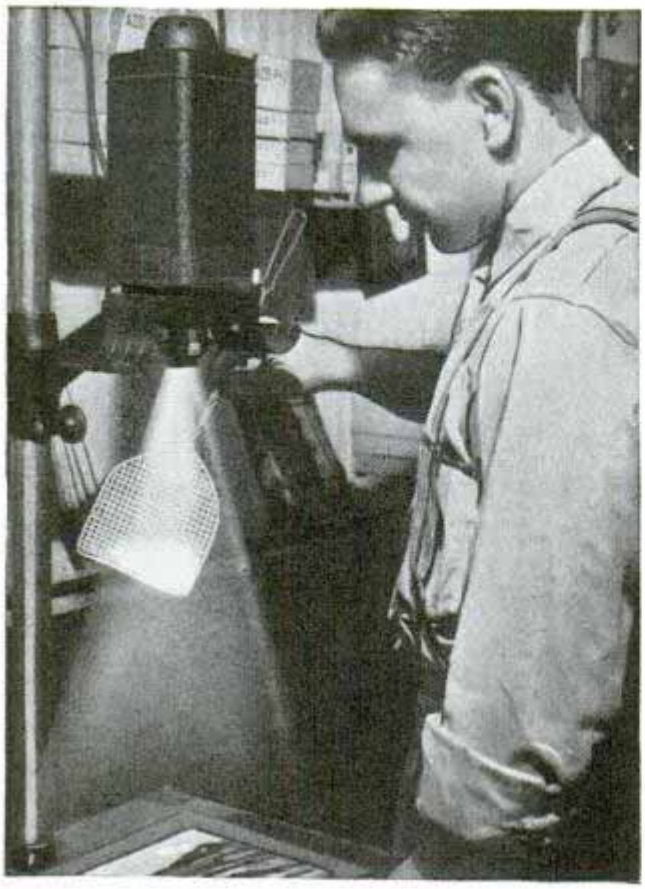
Clamped to the bed of a folding camera, a small steel tape takes the guesswork out of focusing for portraits. Have the subject hold the end of the tape even with his eyes and a glance at the other end will show where to set the footage scale. A small C-clamp soldered to the case as shown in the inset will hold the tape in place on the camera.

Three Ways to Keep Ferrotype Tins from Being Bent or Scratched

Ferrotype tins will not fall when set against a radiator or the wall and are less likely to be bent if two corners are fitted with round cork fishline floats or the rubber guards from an auto hood. To lay tins on top of each other without scratching them, cement small cork disks from bottle caps on the back at each corner.



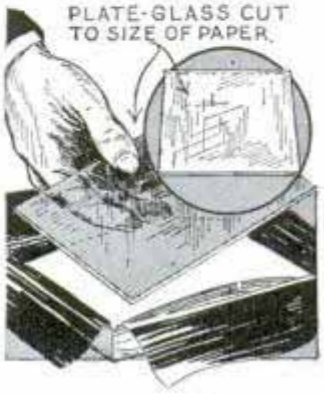
Fly Swatter Acts as a Light Sieve in Diffusing Enlargements



Soft, diffused effects, so often desired in enlargements of portraits, are easy to get by using an ordinary ten-cent fly swatter as shown in the photo. It is best to remove the binding from the edge of the wire so there is no danger of it cutting off light. To increase the amount of diffusion, tilt the fly swatter at an angle—the greater the tilt, the greater the diffusion.

Paper Held Flat by Piece of Glass Does Not Curl in Box

Photographic papers can be kept from curling after the box has been opened by weighting them with a piece of heavy plate glass. Cut the glass the same size as the paper and rub the edges on a piece of emery paper to remove the sharpness. Keep it in the box when the paper is not being used. If the glass is painted black or wrapped in black paper it will also prevent fogging of the paper if the box is opened accidentally in the light.



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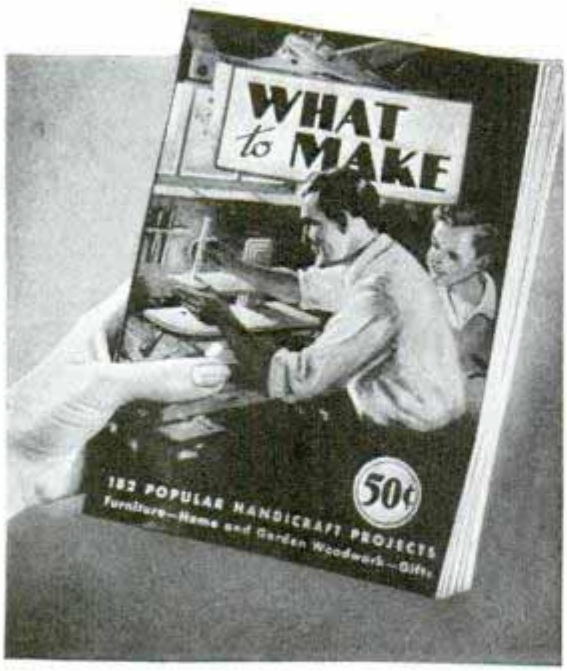

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COMPACT SETS of Advanced Design

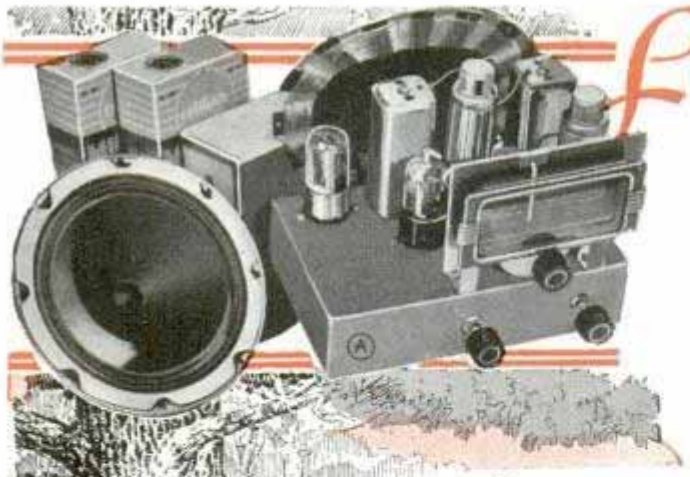
UTILITY and convenience are outstanding features in all compact receivers for 1940. Push-button tuning and built-in antenna devices have been improved greatly; auto sets are more sensitive, and the new auto antenna systems now eliminate most of the troublesome motor noises. Portable battery sets are in general use and a common sight on beaches, trains, boats and in other public places where they have become an important unit of personal luggage. New low-drain tubes, small long-life "A" and "B" batteries and miniature power packs that quickly convert these self-contained sets for use on ordinary houselighting lines, are all factors that have contributed to their popularity.

Three types of modern compact table-type and portable receivers are shown in photos 1, 2 and 3. No. 1 is a 7-tube 2-band table model with built-in antenna, slide-rule dial, push buttons for 5 stations, and is equipped with phonograph and television-sound connection. A 5-tube portable is shown in photo No. 2; this set operates either on batteries or a.c.-d.c. current, has built-in antenna, employs the new 1½-volt tubes and is housed in an attractive carrying case. No. 3 illustrates a type of cabinet styling made possible by molding plastics. Although truly miniature in size, it houses a 5-tube a.c.-d.c. superheterodyne broadcast receiver, with built-in antenna and a 5-in. P.M. dynamic speaker.

Farnsworth Television and Radio Corp. Ft. Wayne

Loop-Operated

By S. Gordon Taylor



ANYONE who has had a little radio construction and wiring experience can build this practical, highly flexible and easily portable superheterodyne receiver. It is battery operated, utilizing four of the most modern 1.4-volt, low-drain tubes, has its own built-in loop antenna and can be installed in any sort of a home-built carrying case the constructor may prefer.

Chassis details are given in Fig. 1. However, this chassis is available punched and drilled and all parts can be obtained in kit form. The only tools actually required for construction are a screwdriver, pliers and soldering iron. A simplified wiring diagram appears in Fig. 2, and the schematic circuit diagram is also given. The first tube serves as a combined mixer and oscillator. This feeds into a high-gain pentode which serves as the intermediate amplifier. Following this comes the 1H5-GT diode-triode, the diode portion of which acts as a detector and automatic volume-control rectifier, and the high-gain triode section operates as the first audio amplifier stage. Last is the 1Q5-GT "beam power" output tube which works into any good 6-in. permanent-magnet dynamic speaker. The speaker-coupling transformer is mounted directly on the speaker and for best results should provide an 8,000-ohm load for the 1Q5-GT output tube plate. This load value will be obtainable from most "universal" type speaker transformers.

The values of all condensers and fixed resistors are given in Fig. 2 except for R5,

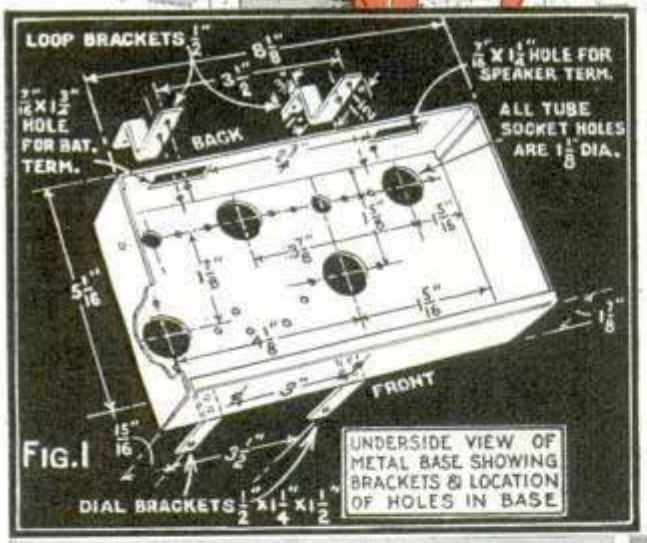
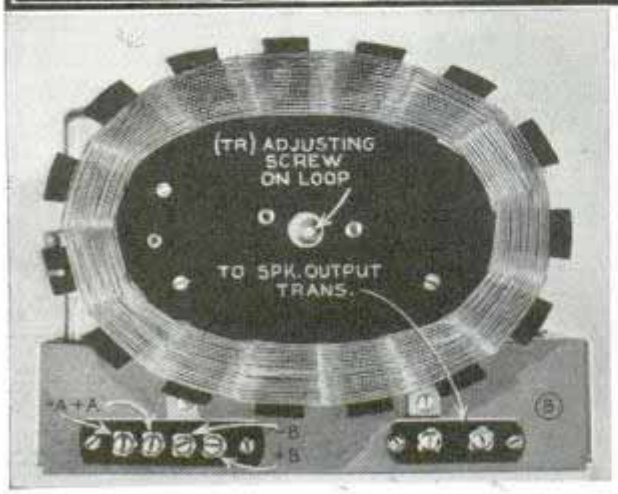
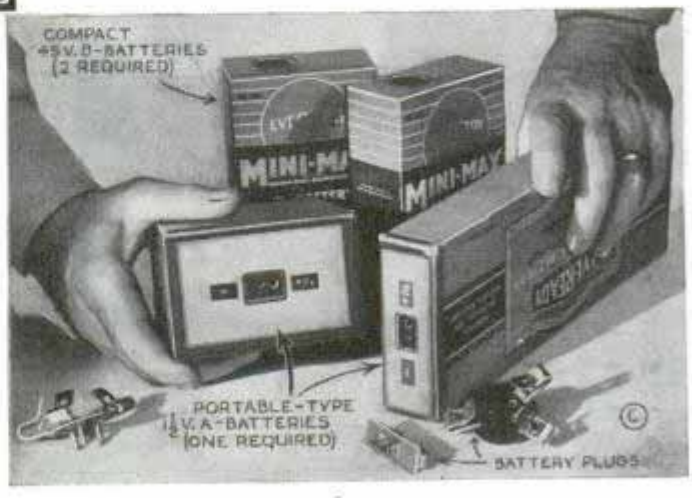

LOOP BRACKETS
8 1/8"
3 1/2"
3/16" X 1 1/2" HOLE FOR BAT. TERM.
BACK
3/16" X 1 1/2" HOLE FOR SPEAKER TERM.
ALL TUBE SOCKET HOLES ARE 1 1/8" DIA.
5 1/16"
FRONT
DIAL BRACKETS 1/2" X 1 1/4" X 1 1/2"
UNDERSIDE VIEW OF METAL BASE SHOWING BRACKETS & LOCATION OF HOLES IN BASE

FIG. 1



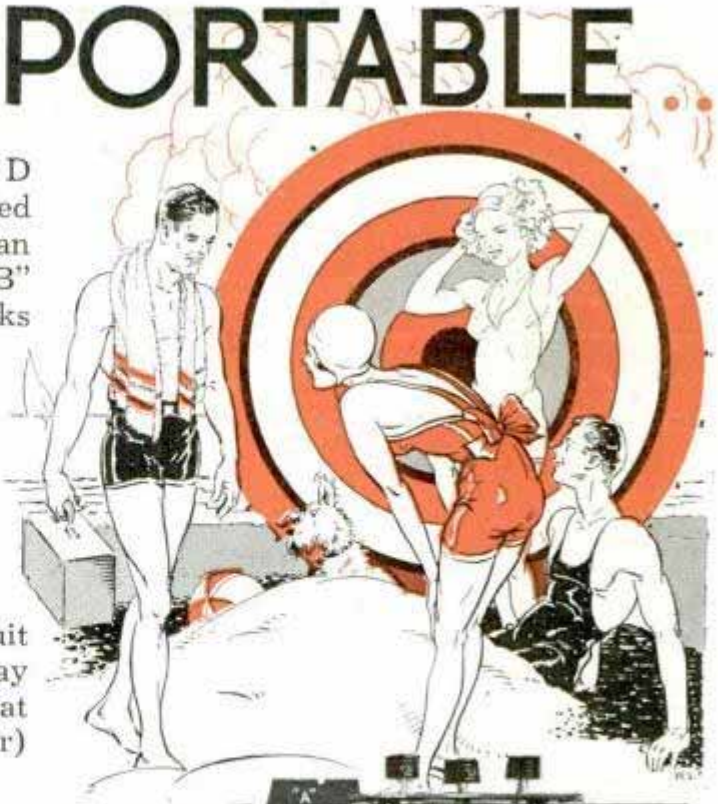


BATTERY PORTABLE

this value is 3 megohms. Photos A, B, D and E show various views of the completed instrument. Photo C gives the reader an idea of the unusually compact "A" and "B" batteries employed; on-off switch breaks both battery circuits. The loop antenna is a spiderweb type, the antenna and ground lugs permit the use of a regular antenna for operation in locations remote from broadcasting stations.

With all wiring completed and carefully checked, connect the leads to the A and B-battery plugs and terminal strip just as shown in the schematic circuit diagram. A fairly accurate alignment may be made by tuning in a distant station at about 1,500 kc. The oscillator trimmer (Tr)

(Continued to page 132A)



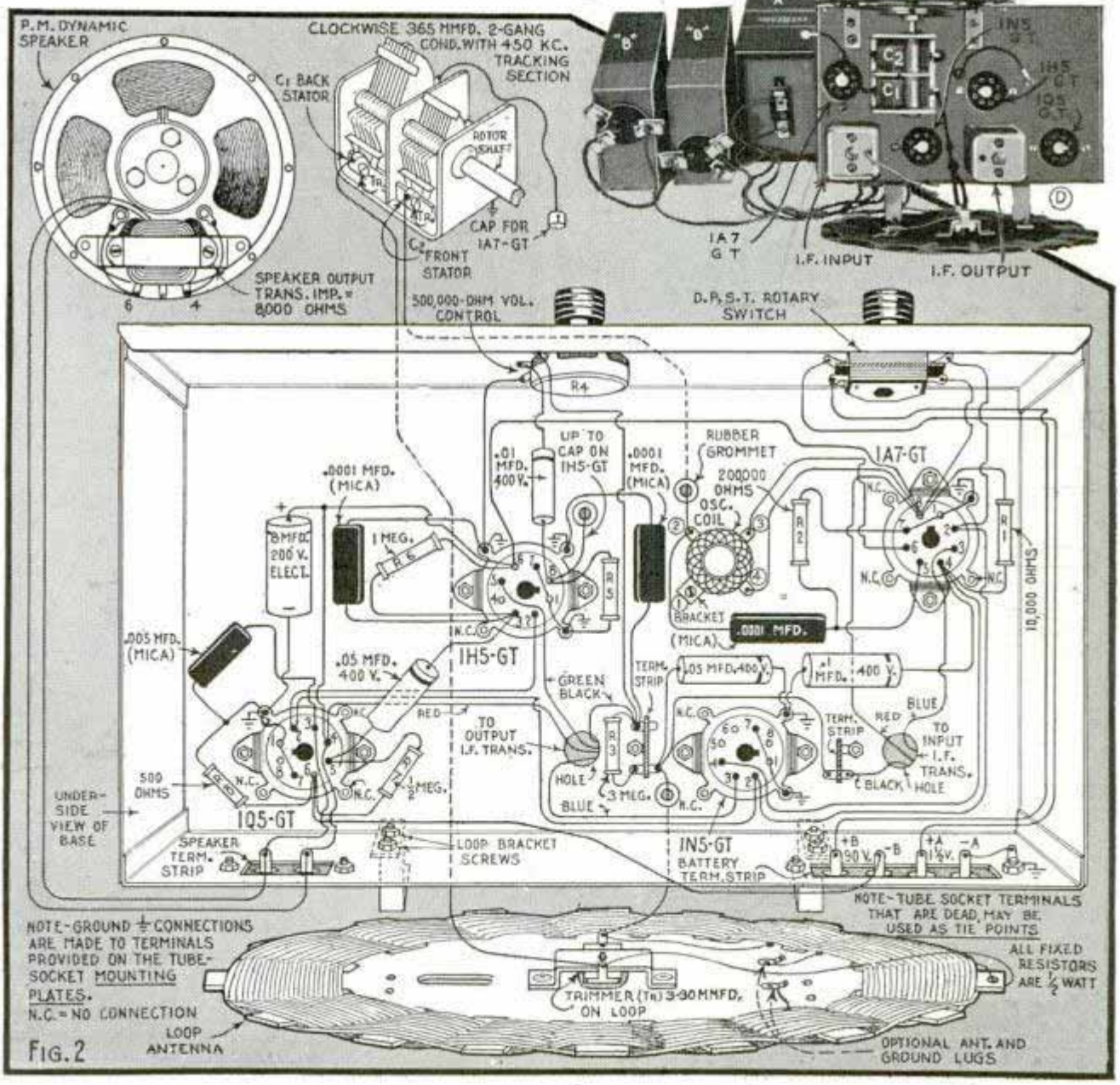


FIG. 2

Rugged Fifty-Foot Telescoping Antenna Mast

By L. B. Robbins

THIS sturdy low-cost radio mast is easy to build and provides the set owner and experimenter with a means for trying out various types of antenna systems. It is constructed in three sections. Fully extended it is nearly 50 ft. high, and it may be lowered to within 15 ft. of the ground for adjustments.

Bottom section No. 1 consists of a tower rising 15 ft. above ground, and is built with four 18-ft. lengths of 4 by 4-in. spruce, 3 ft. of which are embedded in cement. The legs form a square, 8 ft. (outside measurements) on the ground, and 17 in. apart at the top. Two crossing brace boards strengthen the structure on each side. All construction details are given in Figs. 1, 2 and 3. Inside the top of section No. 1, a frame of 2 by 4-in. material, dimensioned as shown in Fig. 2, to form a center slide opening 5 in. square, is lag-bolted in posi-

(Continued to page 134A)

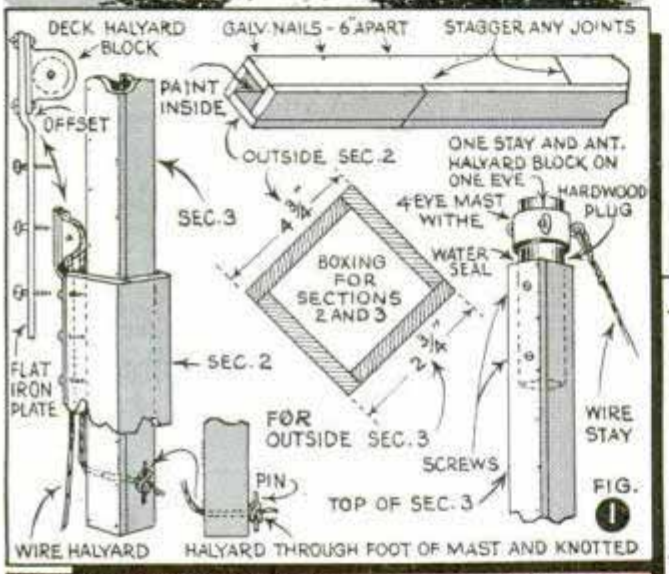


FIG. 1

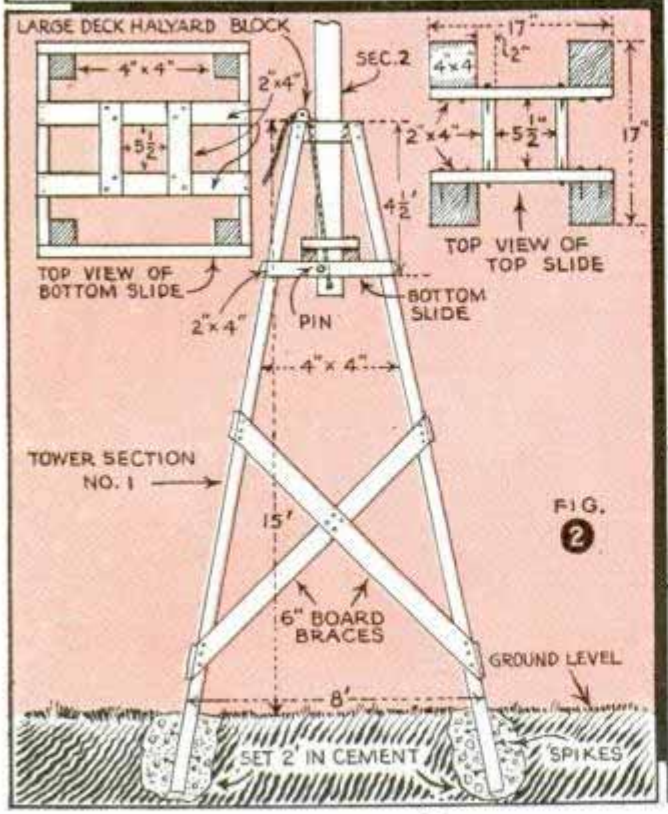


FIG. 2

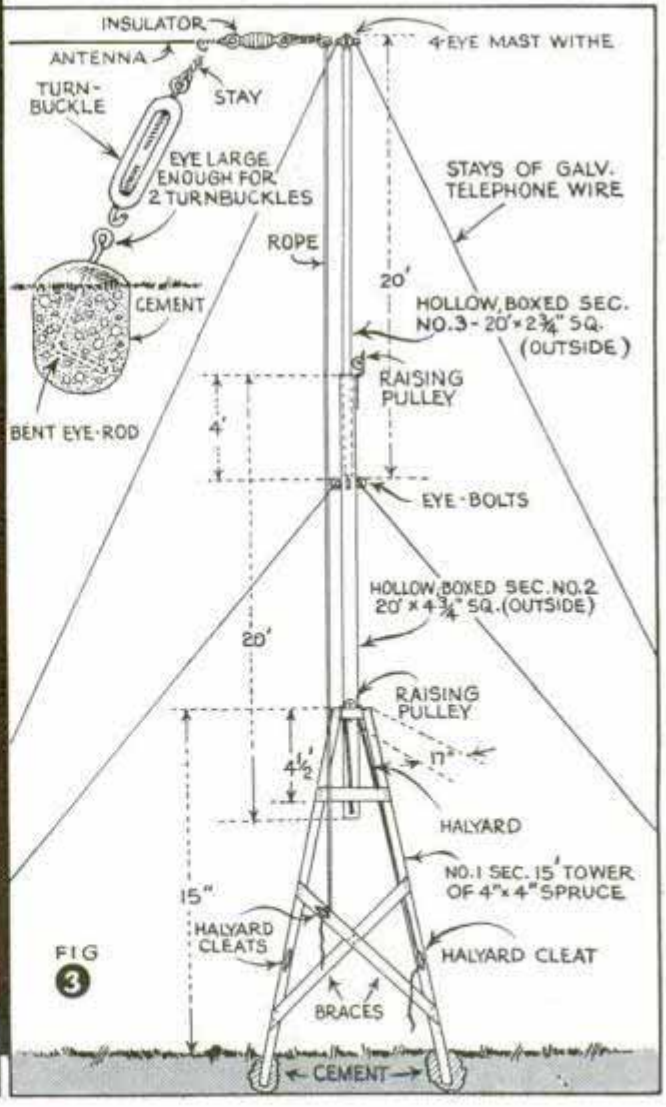


FIG. 3

Hints for RADIO EXPERIMENTERS

No. 1, no technical knowledge is required to install this a.c. unit-type phonograph amplifier in any cabinet or bookcase. It consists of a motor-board unit complete with crystal pickup, self-starting phono-motor, off-on switch and a 9-in. turntable; the 12-watt audio-amplifier unit has external volume and tone controls; a 12-in. P.M. type dynamic speaker completes the assembly. Photo No. 2, plug-in power-cord antenna substitute makes a portable set of any small receiver

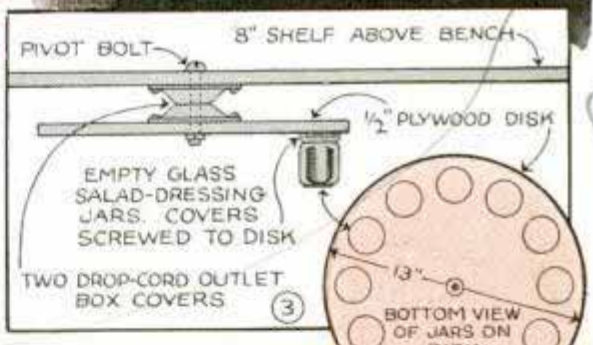
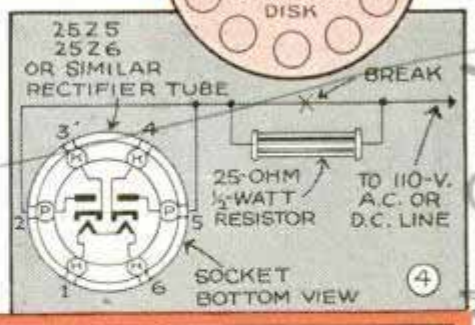
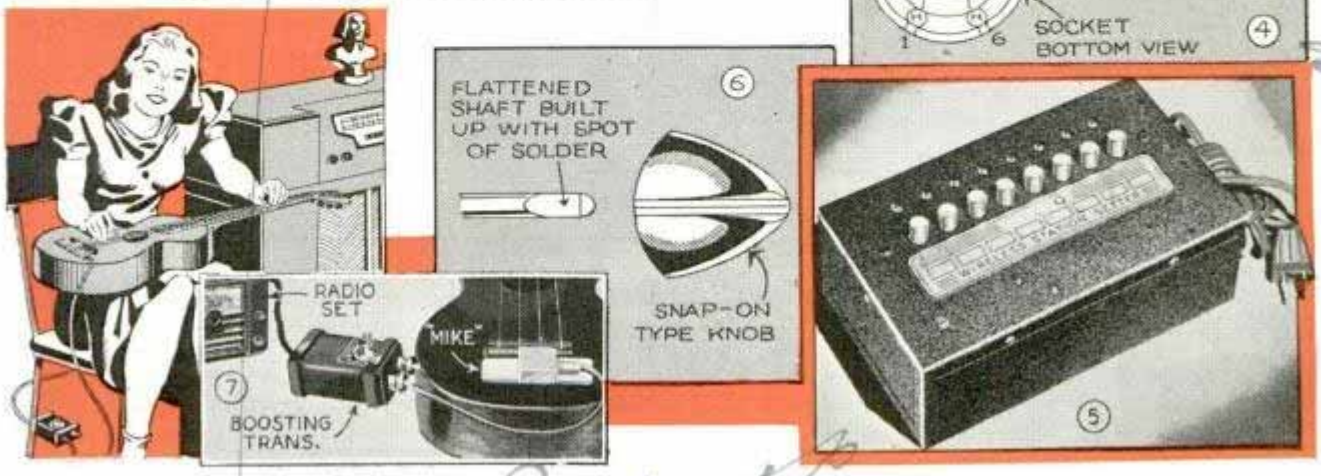


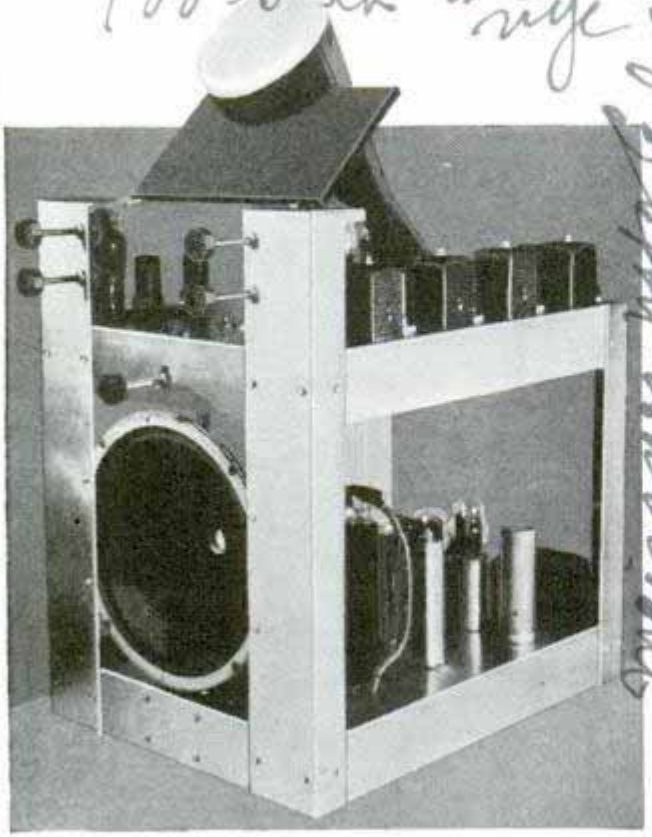
Fig. 3, circular bin pivoted to underside of a permanent shelf above your radio workbench can be rotated for quickly selecting screws, nuts, resistors and other small parts from glass jars. Fig. 4 shows a simple method for prolonging the life of the rectifier tube in your a.c.-d.c. set, in case it does not have a current-limiting resistor. Inserted as shown, the 25-watt resistor limits the peak current during warm-up periods

Photo No. 5, wireless station setter aids serviceman in lining up receivers having push-button tuned stations; eight buttons on this oscillator unit are pressed one at a time, the corresponding station button padder in the receiver is adjusted until the oscillator signal is heard. Fig. 6, easy method for tightening loose control knobs; No. 7 photo and sketch show a boosting transformer which enables any musician to play a stringed instrument through the home radio set. Booster transformer is connected either to phono input of receiver or across the volume control





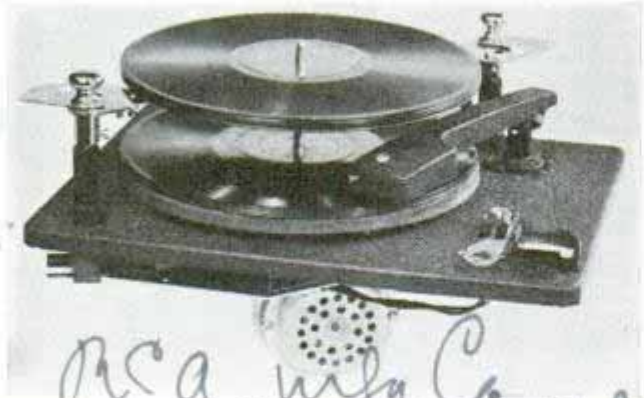
Sight and Sound Kit Receiver on Double-Deck Chassis



Designed especially for home construction, this complete television receiver offers several advantages of interest to students and experimenters. Adequate room is provided on the double-deck chassis, eliminating the usual crowding of parts. Either a 5 or 7-in. cathode-ray tube may be employed without circuit changes.

Automatic Record Changer

Easily installed in any model radio-phonograph combination with a sufficiently large cabinet, this low-cost record changer plays seven 12-in. records or eight 10-in. records automatically. Space required above motorboard is only 4¼ in.

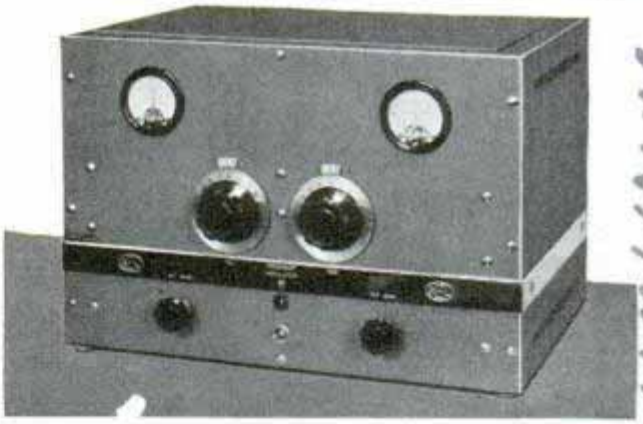


High-Gain Preselector Unit

Weak distant signals in amateur short-wave receivers can be boosted to good readable strength by means of this preselector. A change-over switch permits the operator to connect the antenna to either the "signal booster" or directly to the receiver.

Frequency Modulation Receiver

Built to meet the requirements of laboratory and monitoring service for the "static free" frequency modulation system of broadcasting now under test in eastern states, this receiver has a frequency range of 40 to 44 megacycles, and employs a separate high-fidelity speaker. The received wave is one in which the carrier frequency is constant in amplitude but varies in frequency above and below some mean value in accordance with modulation.



Blueprints covering radio construction articles in this and past issues are available for 25 cents each. Original material lists, with names of manufacturers and dealers, can be obtained from our Radio Department upon receipt of postage.

NEXT MONTH—Six-Tube Three-Band Receiver for Students and Experimenters. This 3-band super is a further development of the 4-tube set described in the December, 1939, issue; the same materials are employed and a few parts are added. Both articles are complete in every detail. Also—**Group Code-Practice Set**

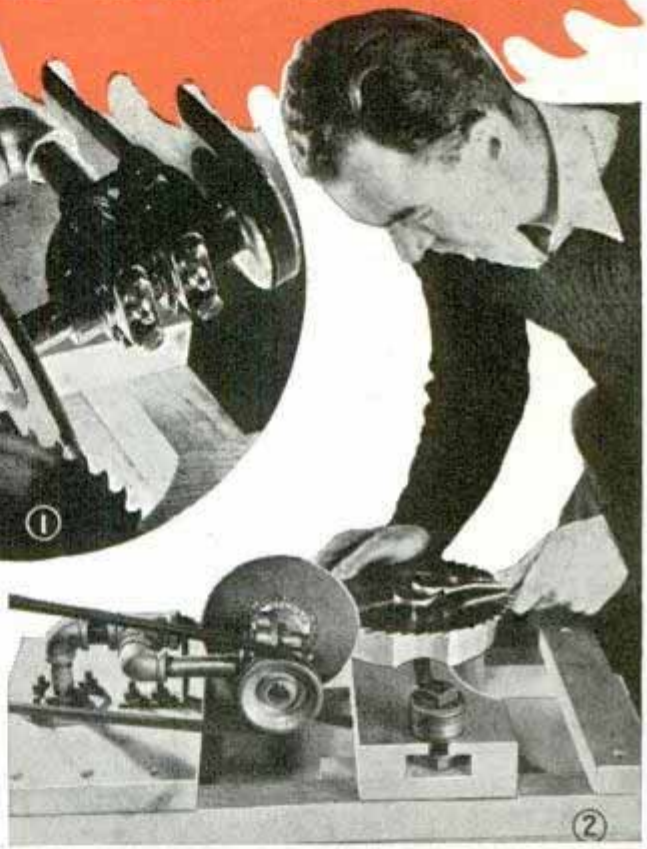
SHOP NOTES

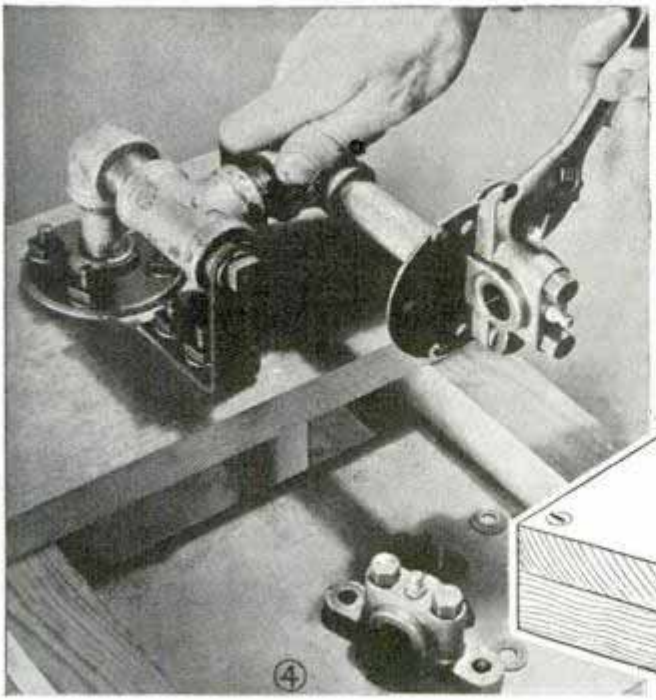
SHARP SAWS

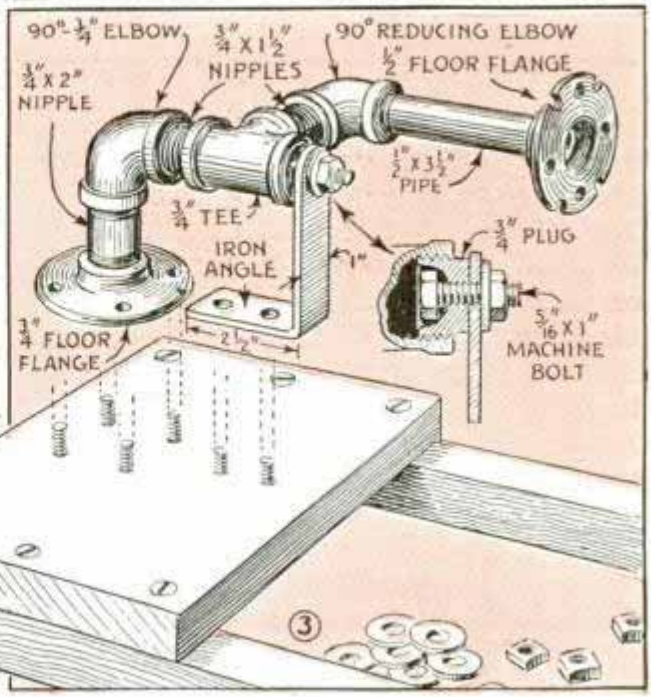
Uniform teeth on circular-saw blades by using this tilting-arbor grinder

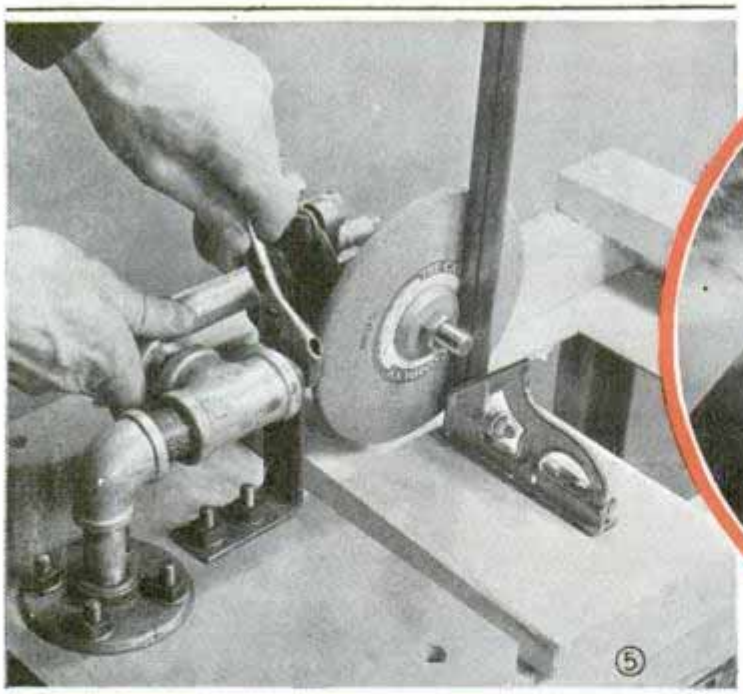
By
Howard R. Heydorf

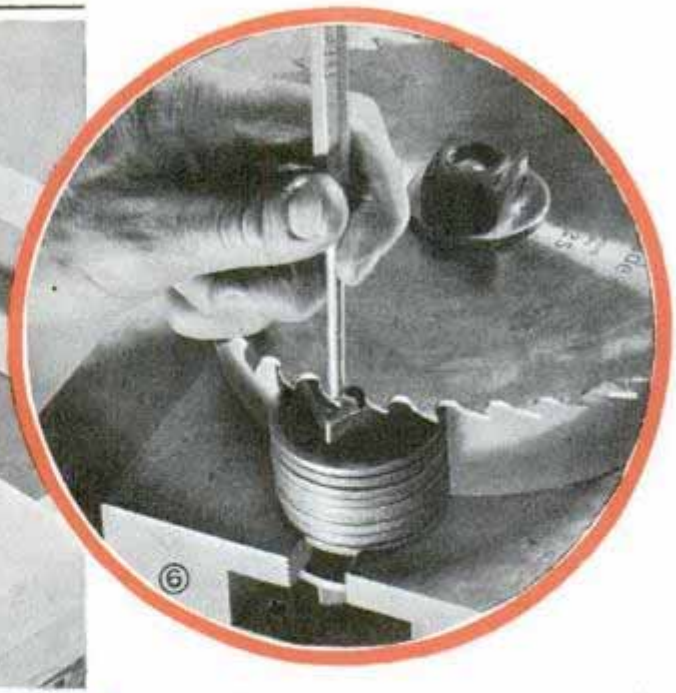
WHETHER it is used for cutting heavy material or accurate miters, the speed and accuracy of the workshop saw will depend almost entirely upon the condition of the saw blade. On some types of combination blades the teeth can be sharpened completely on a grinding wheel mounted on a tilting arbor. The latter can be made from an old polishing head and standard pipe fittings. The arbor and pipe supports, Fig. 4, are mounted on a

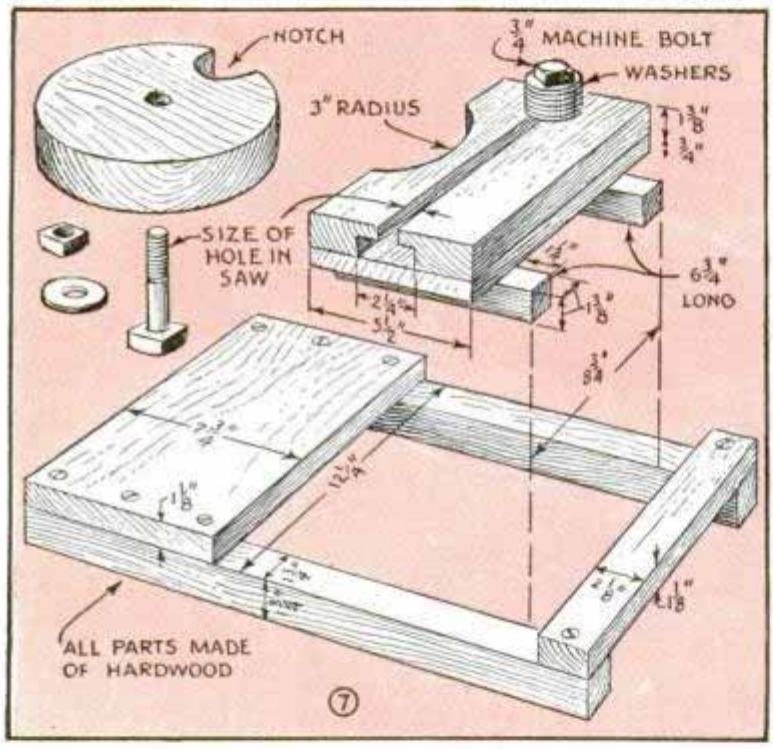










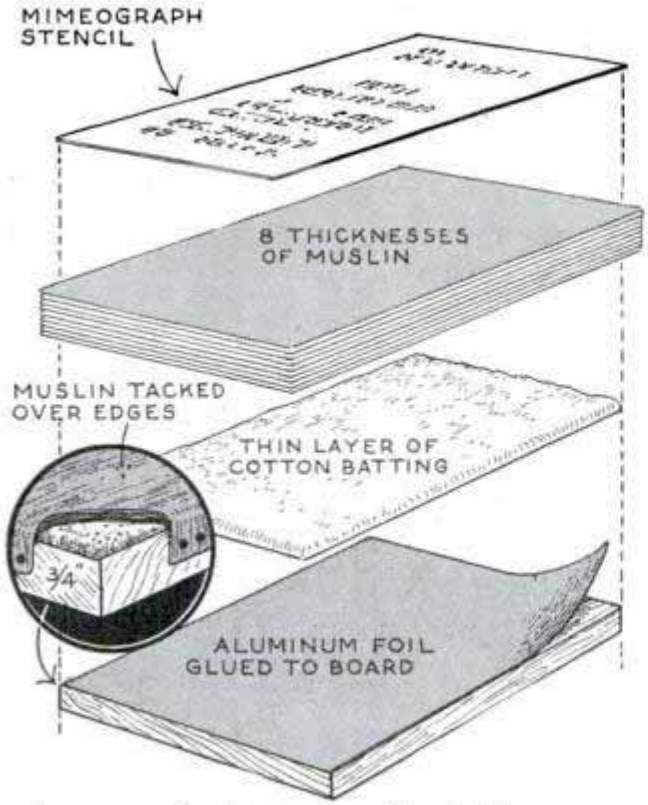


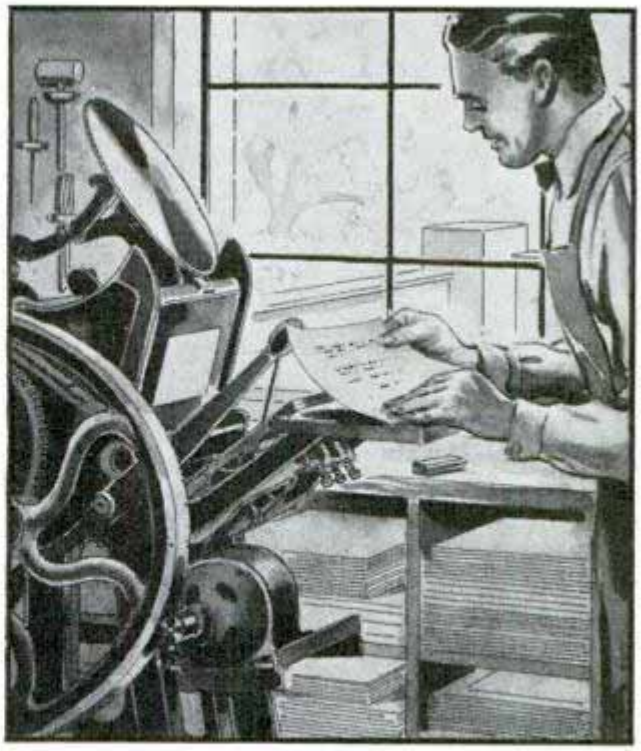
pair of wooden rails which are fastened together with a heavy wooden piece which forms the base for the tilting arbor, Fig. 3. The sliding support which holds the saw blade is made as shown in Fig. 7. A T-slot on the top allows the setting stake and blade support to be fastened in place. A notch should be cut in the rim of the disk to allow the setting stake to be located directly under the teeth. The bolt that holds the supporting block to the sliding carriage is the same size as the hole in the saw blade. The setting stake is a ¾-in. machine bolt shimmed with washers to bring the head of the bolt flush with the top of the wooden disk. A corner of the bolt head is filed to the correct angle for the set of the saw teeth.

Make a paper pattern of the blade before you sharpen it. The depth of the gullet as well as the angle of the front and back of the tooth should be shown. Jointing the teeth is done by reversing the blade on the arbor and raising the saw table. An oilstone is placed over the slot and the table is lowered, with the motor running, until the teeth strike the oilstone. The blade is then fastened on the wooden disk of the sliding carriage, Fig. 2. When much material is to be removed from the teeth it is best to sharpen them first and set them afterward. Otherwise it is best to set them first, Fig. 6.

The grinding wheel is set at right angles to the bed of the machine as in Fig. 5. The disk is fastened in the correct position to grind the gullets and a stop block for the carriage is provided to limit the cut. After the first gullet is ground the carriage is moved back and the blade is turned slightly to grind the next. Using the same method the front and back of the teeth may be ground. Of course, the wooden disk must be adjusted to secure the correct angle. When the teeth are beveled the wheel is tilted at an angle as shown in Fig. 1. The front or back of the tooth may be beveled in this manner. The best results will be obtained by allowing the wheel to enter the gullet and then revolving the blade to move the tooth against the wheel. Very little grinding is required and the tooth should barely touch the wheel.

Small Printing Press Serves as a Duplicator

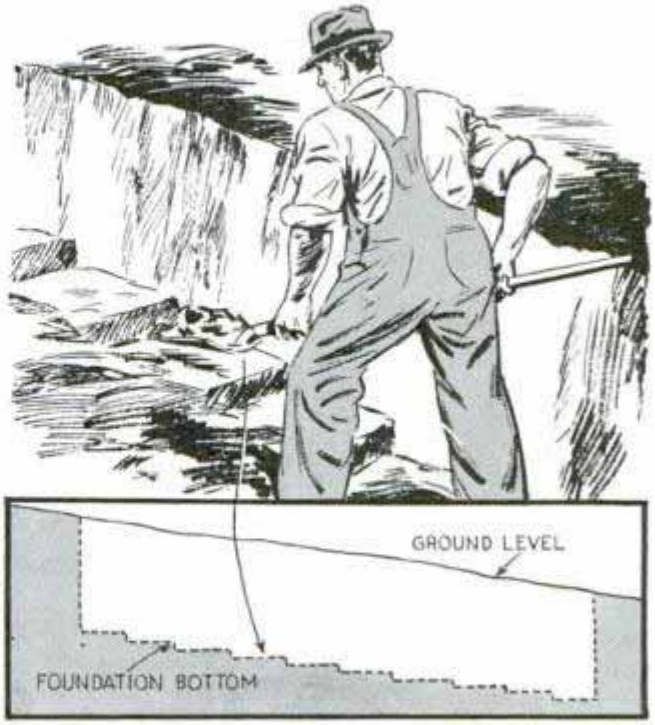




Anyone who has a small printing press can use it to do mimeograph work. All you need is an ink pad locked in the chase, and a mimeograph stencil, which is pressed firmly on the pad where it will adhere. The ink rollers are removed when using the press as a duplicator. To make an ink pad, get a 5 by 8-in. block of wood which does not warp easily. If a block larger than this is used, a metal backing may be necessary to prevent warping. One printer used a metal-backed block of wood 7½ by 11 in. in a 6 by 10-in. press so that he could mimeograph standard 8½ by 11-in. sheets. Cover the block first with aluminum foil, then a layer of cotton batting and on top of this apply eight thicknesses of muslin. Tack the assembly to the edges of the block, smoothing the cloth carefully. Then saturate it with duplicating ink that has been thinned slightly with glycerin.

Bottom of Sloping Foundation Stepped to Avoid Cracks

When laying a concrete or masonry foundation on sloping ground for a building, slope the trench so that the low side of the wall is in the ground the same depth as the high side. And, instead of gently sloping the bottom of the trench, step it as indicated. When done in this way and the corners reinforced, there is little possibility of cracking or sagging.



Auto Casings on Wagon Wheels Eliminate Mud Chunks

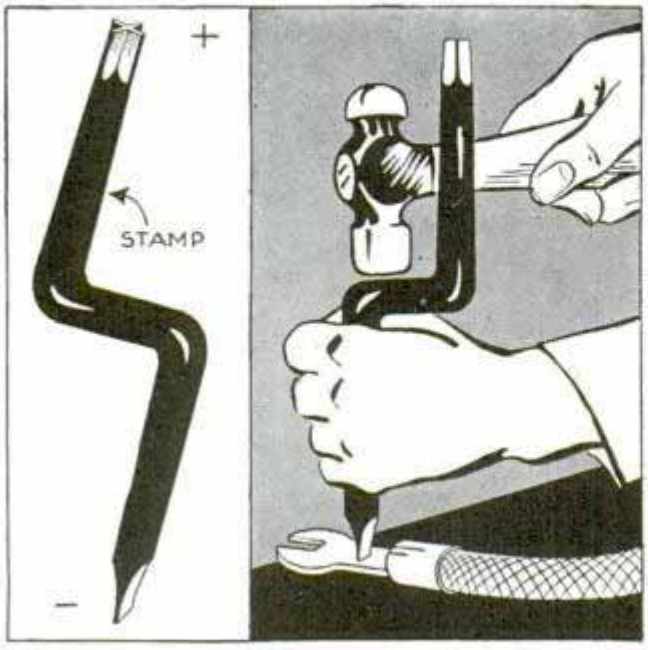
Besides preventing chunks of mud from collecting on wide-rim wagon wheels, old auto casings slipped over them make riding easier when the ground is frozen. Casings slightly larger than the wagon wheel are cut in two, slipped over the wheels, and wired together near the bead.

Scales Carried on Barrel Handy in Taking Inventory

When taking inventory in a store and it is necessary to move the counter scales around to various locations for weighing stock on hand, set them on an empty barrel. Then set this on a dolly or stove truck and the assembly can be pushed around easily as required, the barrel supporting the scales at a convenient height.

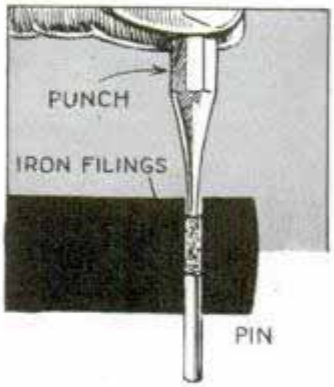
Positive and Negative Stamp for Terminal Connections

Shaped from a short piece of drill rod, this tool is just the thing for quickly stamping identifying marks on the terminals of electric wires. All you need to do is bend the rod to the shape indicated, file the ends to form positive and negative characters and then temper the rod.

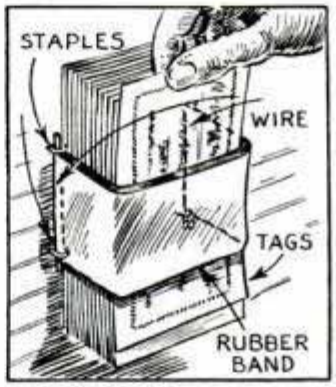


Iron Filings Aid in Driving Pin with Short Punch

If a tight pin or bolt has to be driven through metal with a short punch, one blacksmith pours iron filings into the hole. Compressed by the punch, the filings force the pin out.



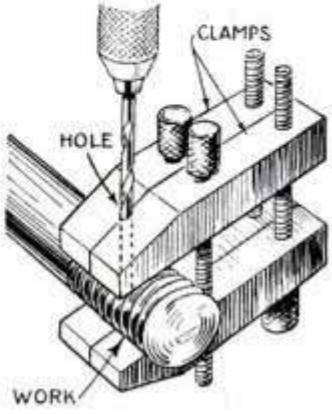
Rubber Holder Dispenses Tags One at a Time



Where quantities of shipping tags or labels are needed, this holder will be just the thing to keep them conveniently at hand. All you need to make it is a piece of old inner tube slightly narrower than the tags, which is fastened to the wall by means of nails or lengths of wire slipped through the inside of the band and held in place with four staples as shown. The rubber will hold the tags securely in place until the last one has been removed.

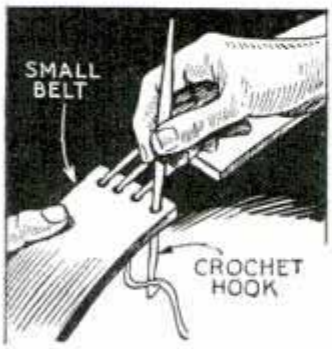
Machinists' Clamps Used as Guide When Drilling Threaded Shafts

A couple of small machinists' clamps make a good guide for starting a drill in the threaded portion of a shaft or other round work. Half-circular grooves are filed or ground in the



sides of the upper jaws of the clamps to form a hole when the jaws are placed side by side on the work. A small drill is run through this hole into the work a short distance. Then the clamps are removed and a drill of the correct size used to make the hole, the small hole part way through the work serving as a guide to prevent the larger drill from moving sideways.

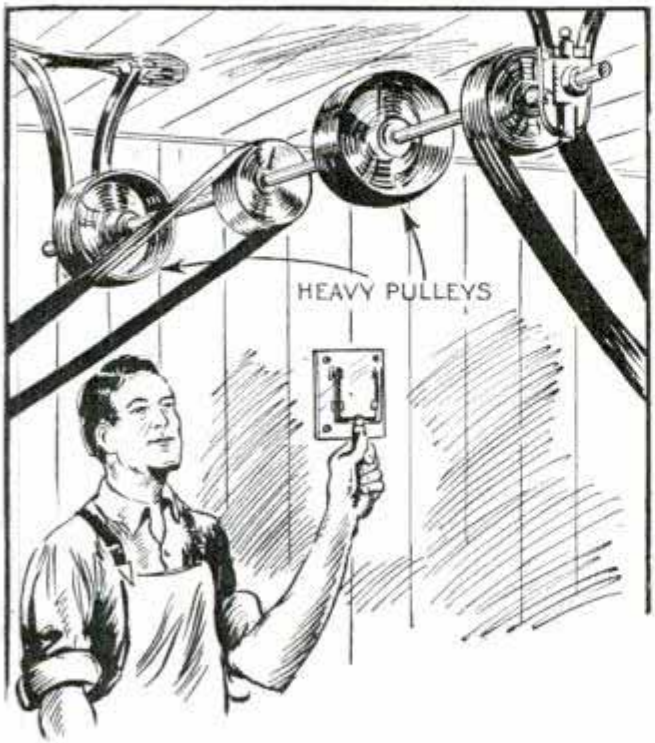
Crochet Hook Helps Lace Belt



Lacing of small belts with leather or rawhide is simplified if a metal crochet hook is employed to pull the lace ends through the holes. It is necessary to use a large hook, which can be made from a small brass rod, if a suitable one is not at hand.

Eliminating Vibration of Shafts by Means of Heavy Pulleys

Uneven pulses and vibrations in a line shaft often can be eliminated by using a few heavy pulleys as flywheels on the shaft. To a large extent, this prevents transmission of uneven vibrations to the driven machines. The pulleys should be balanced perfectly so that they will not impart vibrations of their own to the shaft

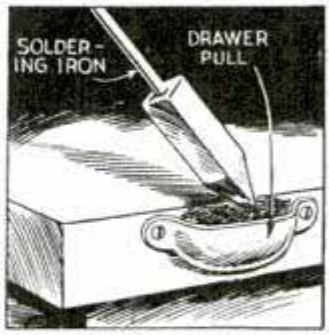


Drive Shaft Good Tamping Stick When Setting Posts

You will find that an old car drive shaft with the pinion on the end makes a good tamping stick for packing soil around fence posts. The shaft provides a good handle, and is heavy enough to pack the soil firmly.

Drawer Pull Holds Steel Wool to Clean Soldering Iron

If you screw a drawer pull to the edge of your workbench in a convenient position and pack it full of steel wool, the latter always will be at hand for quickly cleaning the point of your soldering iron. If the wool tends to work out of the drawer pull, drive a long sheet-metal screw through the side of the pull so that the end projects into the wool.



When waterproofing the canvas on a boat, one builder claims that a thin coat of water glass and one coat of paint produces the same results as three coats of paint.

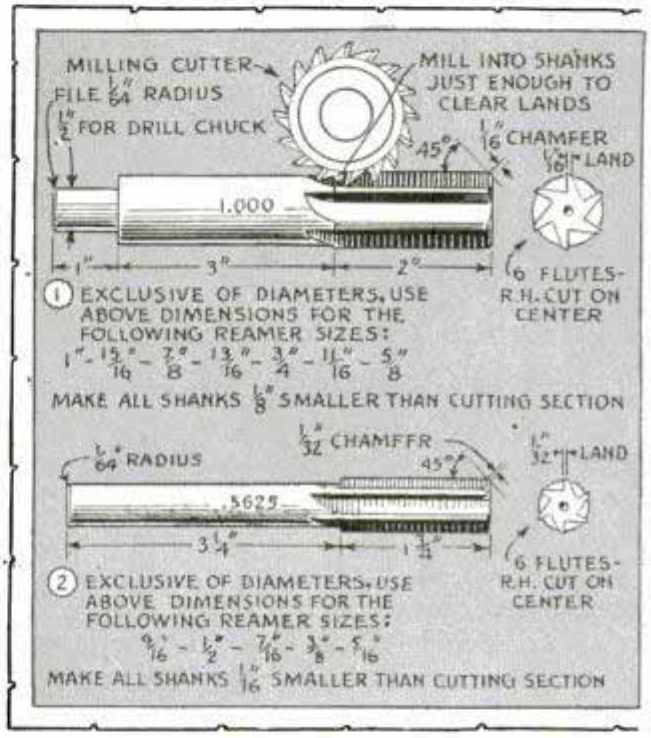
REAMERS and made in your

By H. J. CHAMBERLAND

BORING work to precisely a predetermined dimension is not difficult if you have an assortment of reamers and counterbores at hand. Reamers are strictly precision tools and perform best when they remove a minimum amount of stock, 1/64 in. being about the maximum. Of utmost importance is the fact that with reamers, there is no worry as to the outcome of a standard hole whether it is .004 or .015 in. undersize previous to reaming. Counterbores, while not classed as close precision tools, are very useful around the shop. They are equipped with various sizes of pilots, which serve as aligning members. Counterbores are intended mostly to bore openings for the heads of screws, bolts and similar parts for sinking under the work surface. Usually twelve straight-shank chucking reamers and three counterbores will fill the requirements of any one who has a small metal-working shop. As the process of making reamers and counterbores is somewhat similar to that used in making mandrels and nut arbors, which has been fully described in a previous article, data such as material required and method of hardening need not be repeated.

Figs. 1, 2 and 3 show how the recommendations for dimensions have been simplified so that anyone can make the tools. While it is necessary in a case of this kind to deviate from manufacturers' standards as to individual length, shape of flute, etc., practicability and quality of the tools have not been overlooked. You will notice that all sizes in each group are of identical length, which tends to keep turning and grinding cuts straight and thus eliminates frequent changes in tailstock adjustments.

You may center the stock your own way and according to available facilities but do not countersink it more than necessary. Also, allow for facing. A 1/16 by 3/16-in.

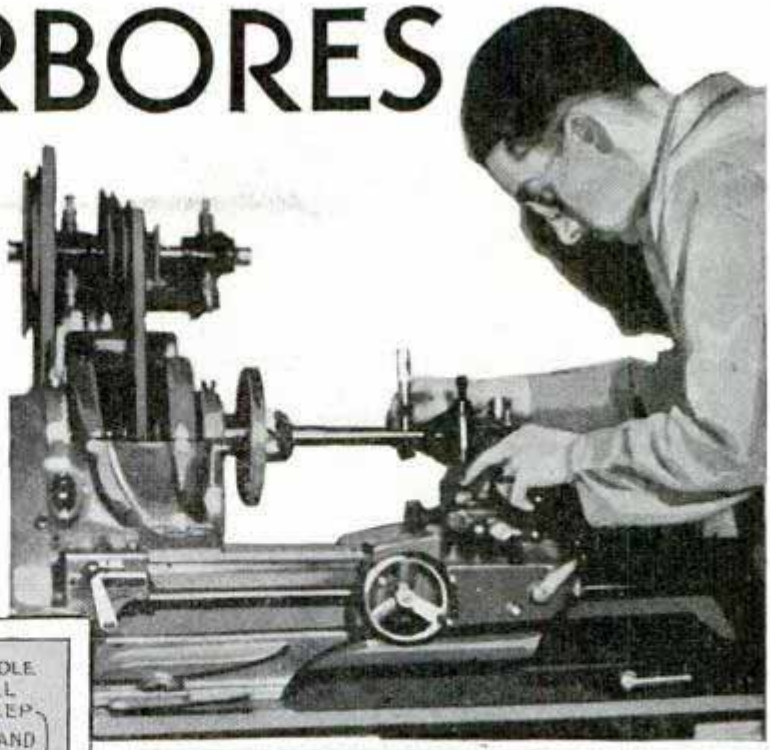

MILLING CUTTER
FILE 1/64" RADIUS
MILL INTO SHANKS JUST ENOUGH TO CLEAR LANDS
1/2" FOR DRILL CHUCK
45°
1/16" CHAMFER
1/16" LAND
1.000
1"
3"
2"
6 FLUTES-R.H. CUT ON CENTER
1 EXCLUSIVE OF DIAMETERS, USE ABOVE DIMENSIONS FOR THE FOLLOWING REAMER SIZES:
1" - 15/16" - 7/8" - 13/16" - 3/4" - 11/16" - 5/8"
MAKE ALL SHANKS 1/8" SMALLER THAN CUTTING SECTION
1/64" RADIUS
1/32" CHAMFER
45°
1/32" LAND
.5625
3 1/4"
1 1/4"
6 FLUTES-R.H. CUT ON CENTER
2 EXCLUSIVE OF DIAMETERS, USE ABOVE DIMENSIONS FOR THE FOLLOWING REAMER SIZES:
9/16" - 1/2" - 7/16" - 3/8" - 5/16"
MAKE ALL SHANKS 1/16" SMALLER THAN CUTTING SECTION

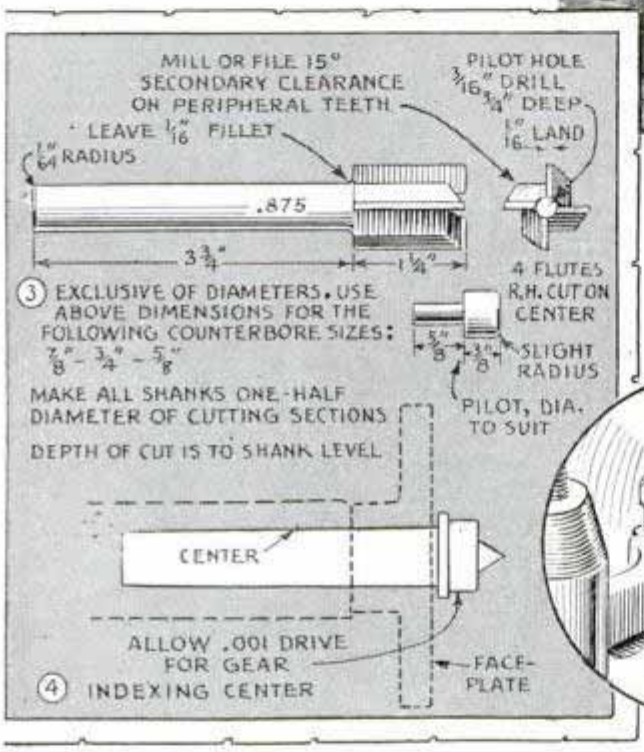
combination center drill is about the correct size to use. The turning operations are routine, .010 to .012 in. being allowed on all cutting dimensions for grinding purposes. Shank dimensions are not critical and a variation of 1/64 in. either way will do no harm, exclusive of the 1/2-in. undercut, Fig. 1, which should be to size or slightly undersize. Assuming that you have a milling attachment for your lathe, but have done little of this work, and want to do the work as economically as possible, get an assortment of worn milling cutters from a machine shop or metal-working plant. Usually these can be purchased at scrap-metal prices, and a good-natured boss may sharpen them for you at no extra cost. For the present, select a small double-side mill about 2 1/4 to 2 1/2 in. in diameter, with a

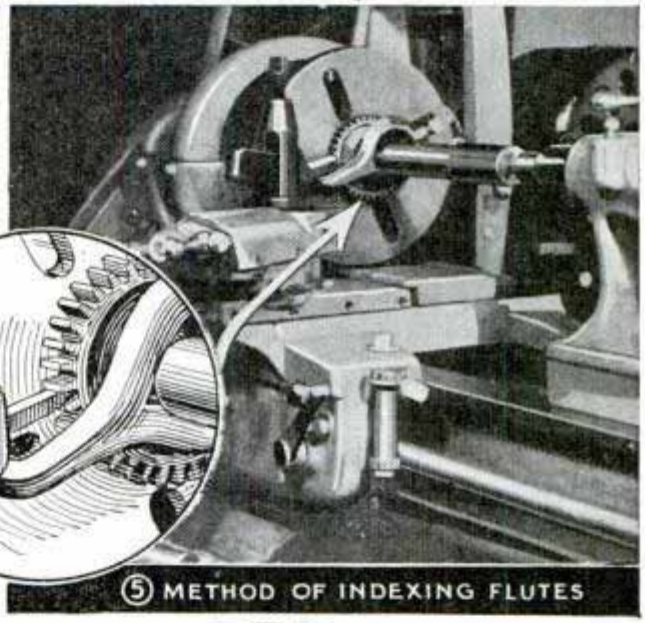
COUNTERBORES

own shop

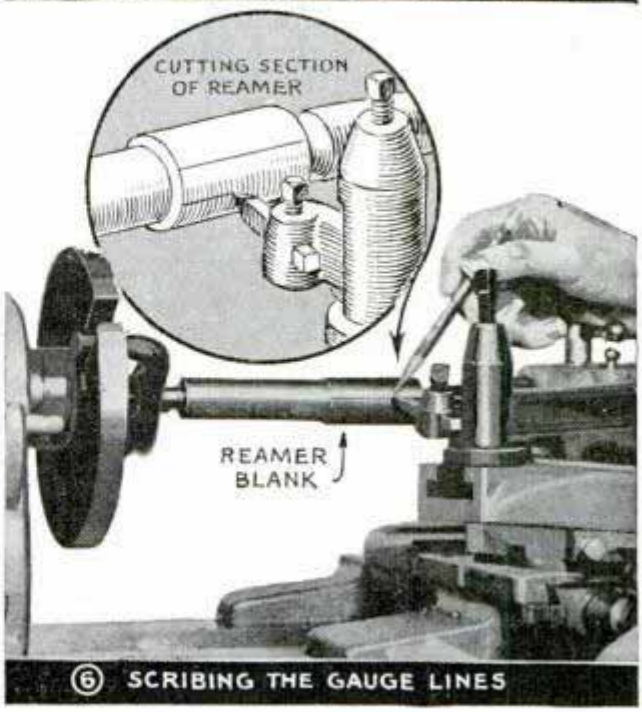
½-in. face. Your next move is to make a soft-steel arbor as shown in Fig. 8. Be sure that its shank fits perfectly into the lathe spindle. If the cutter is pressed on with a .002 drive, it will be rigid and will stand ten times the feed that you will give it. Such an improvised arbor serves the purpose well and the cutter may be sharpened easily without removing it.



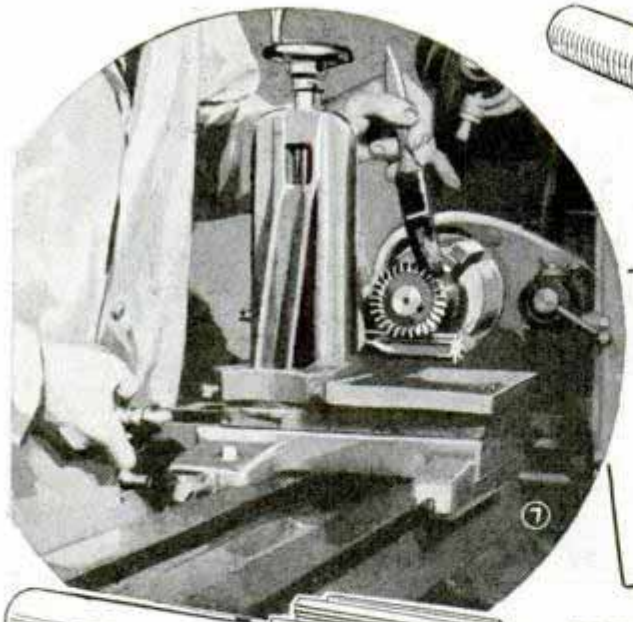

MILL OR FILE 15° SECONDARY CLEARANCE ON PERIPHERAL TEETH
PILOT HOLE 3/16" DRILL 3/4" DEEP
LEAVE 1/16" FILLET
1/64" RADIUS
1/16" LAND
.875
3 3/4"
1 1/4"
4 FLUTES R.H. CUT ON CENTER
3/8"
3/4" SLIGHT RADIUS
PILOT, DIA. TO SUIT
③ EXCLUSIVE OF DIAMETERS, USE ABOVE DIMENSIONS FOR THE FOLLOWING COUNTERBORE SIZES: 7/8" - 3/4" - 5/8"
MAKE ALL SHANKS ONE-HALF DIAMETER OF CUTTING SECTIONS
DEPTH OF CUT IS TO SHANK LEVEL
CENTER
ALLOW .001 DRIVE FOR GEAR
FACE-PLATE
④ INDEXING CENTER

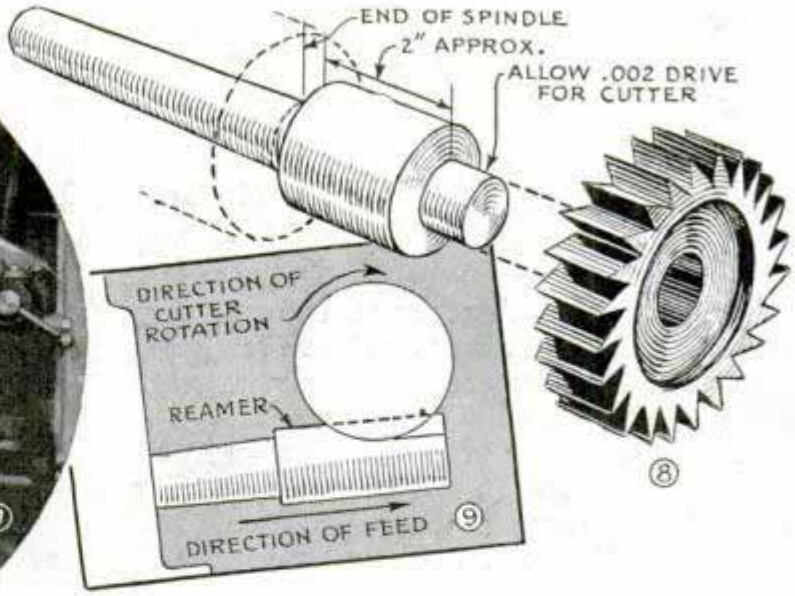

⑤ METHOD OF INDEXING FLUTES

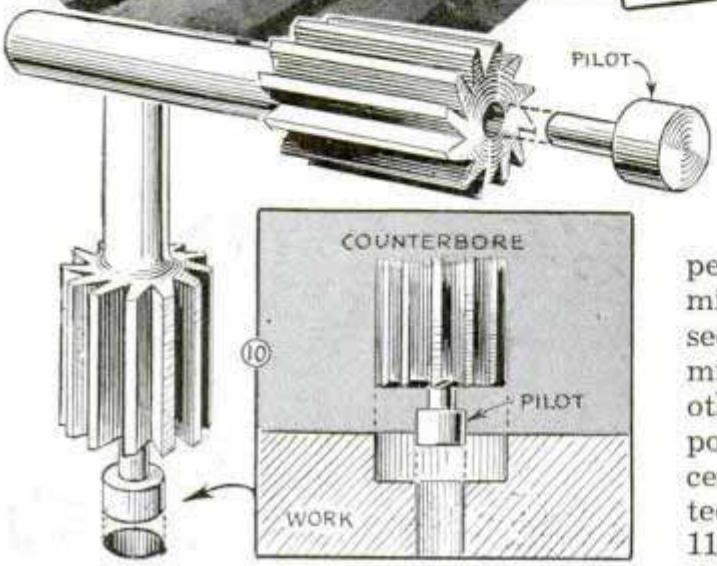
Now you are ready to do some milling but probably wonder how you are going to index the flutes evenly in the reamers or counterbores. If your lathe has indexing facilities in the headstock, you proceed as follows: Grind a tool bit to a V-shape and mount it in the tool holder exactly in the center of the work. All you have to do now is to scribe the required number of divisions on the cutting sections of the blanks, as shown in Fig. 6. If you have no indexing facilities on your lathe, you can get the same results by fitting a 36-tooth threading gear to a special center made and used as in Figs. 4 and 5. Note in this case that the bit serves as a plunger as well as a scriber.



⑥ SCRIBING THE GAUGE LINES



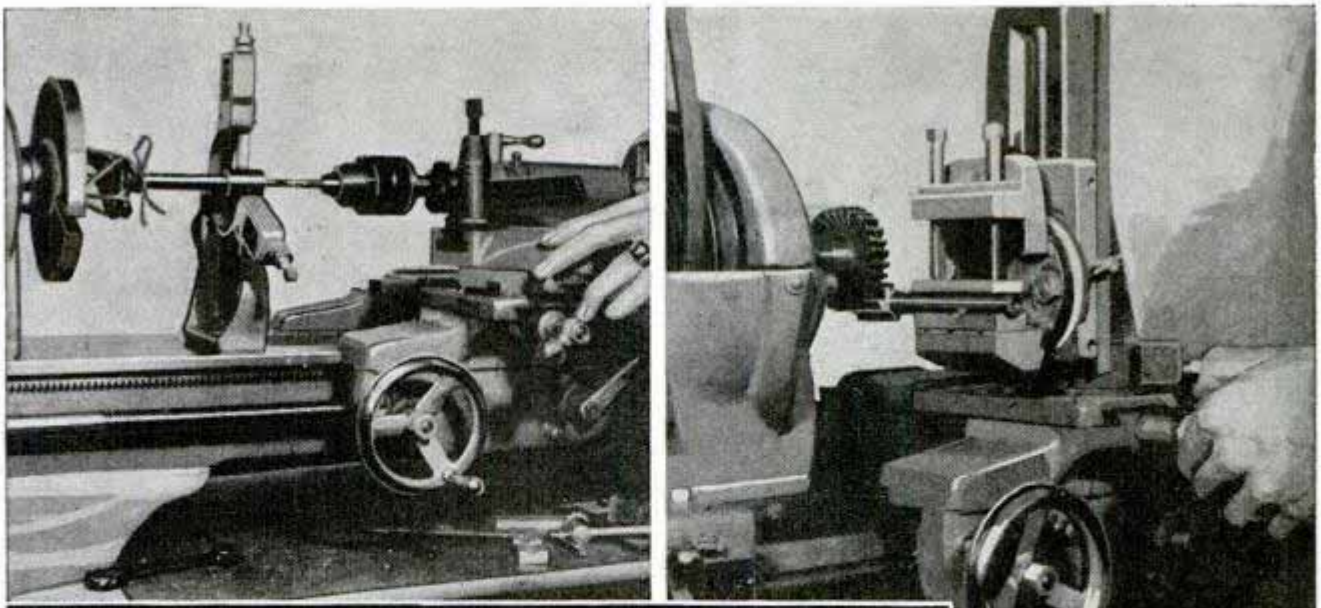




The work should be held tightly between centers before drawing the lines. Of course, with either set-up the dog should be locked into the faceplate slot.

The last flute of the 1-in. reamer is about to be completed in Fig. 7. It is clearly demonstrated that with this form of milling, the direction of spindle rotation must be reversed and the infeed is away from the operator, as described in Fig. 9. Being guided by correctly spaced scribed lines, it is only necessary to bring all scribed lines into position for milling, if the cutting side of the mill is located directly on the center of the blank being milled. The spacing of flutes will be surprisingly accurate if the above instructions are followed closely. The depth of flute is governed by the diameter of each tool and width of land required. Lard oil should be applied freely during a milling operation and a small pan should be used to catch all drippings. The depth of cut should not exceed $\frac{1}{16}$ in., the feed should be slow and a 2½-in. cutter should rotate at 300 r.p.m. for a correct surface speed. Small reamers and counterbores must have some support while milling them to avoid any springing and chattering. Pilot holes in counterbores should be drilled as in Fig. 11. The procedure for milling peripheral teeth is the same as that for milling reamers. Counterbores require a secondary clearance, which in this case is milled with an angular cutter. On the other hand, the side mill serves the purpose by shifting the center line ahead of center to obtain the desired angle. The end teeth of counterbores are milled as in Fig. 11. The milling fixture is adjusted for proper height of concaved cut which should be equivalent to a 55° angle. End teeth of counterbores smaller than ½ in. should be filed rather than milled.

Next comes the job of hardening the tools. If you have a small gas or electric furnace follow instructions given for mandrels and arbors. However, the fact that you have no regular equipment should prove no handicap. Reamers and counterbores need not be hardened over their entire length, therefore the improvised set-up shown in Figs. 12 and 13 will serve the purpose. All you need are four 4 by 8-in. firebricks, an old cast-iron plate and a regular size blowtorch. Arrange the bricks as shown, after cutting an opening for the flame. After starting and locating the torch, place the piece to be hardened shank first into the chamber but without contacting the flame, then close the front. Enough heat will be generated in about 10 min. to relieve the tool of all strain. Now bring the cutting end to a bright red by rotating the work slowly but continuously, and quench quickly. Harden the end of the shank the



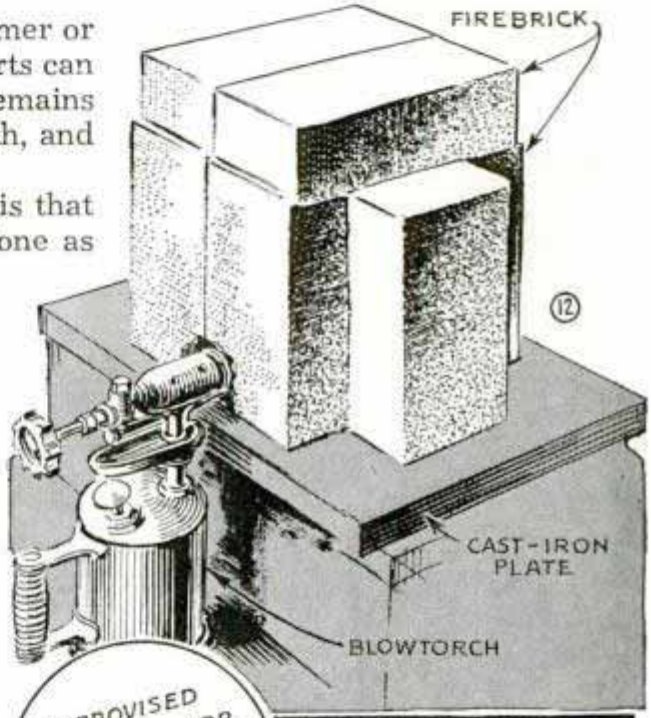
⑪ DRILLING PILOT HOLES AND MILLING FLUTES IN SMALL COUNTERBORES

same way and repeat the cycle for every reamer or counterbore. If any distortion occurs, the parts can be straightened easily as the center portion remains soft. After hardening, clean with emery cloth, and your tools are ready to be ground.

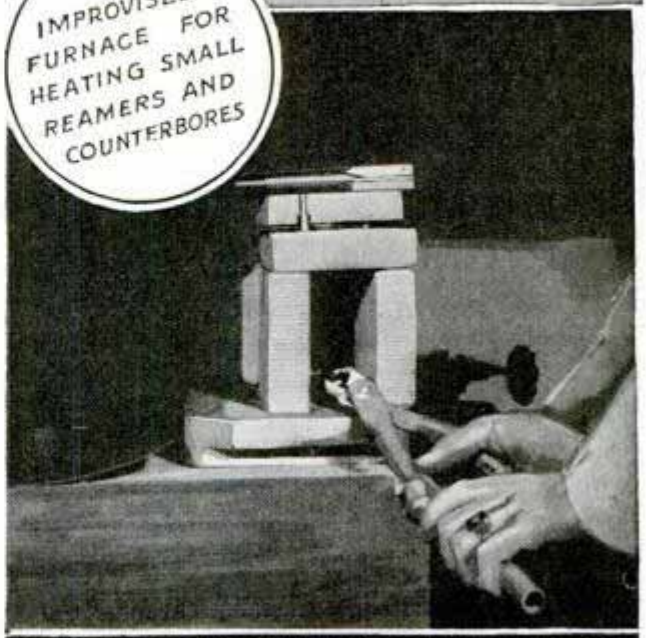
The first grinding operation with reamers is that of surfacing the faces of the flutes and is done as shown in Fig. 14. The purpose is to produce fine edges in connection with the cylindrical grinding operation. It is best to index if possible. Good results can be had by holding the reamer with one hand and traversing the wheel with the other, removing only enough stock to brighten up the faces.

Next comes dressing of the wheel face previous to grinding cylindrically. A diamond dresser is necessary for precision work; small ones are available for a few dollars. The setting must be held rigidly in some kind of fixture bolted to the lathe bed. Regardless of your grinding facilities, the work must always rotate in the opposite direction to that of the wheel. It is advisable to grind the shanks first, Fig. 17. They need only be ground straight and concentric. The wheel traverse movement should be slow and about .0005 in. of stock should be removed per pass. The operator should not attempt to go nearer than .0005 in. from the required finish size.

The next operation with reamers is that of clearing the lands, Fig. 16. The clearance angle should be 4 to 6° to within .005 to .008 in. from the edges. Grinding the 45° chamfers completes the reamers. This operation is done by setting the compound rest accordingly. The clearance should be 5 to 7° and to sharp edges.

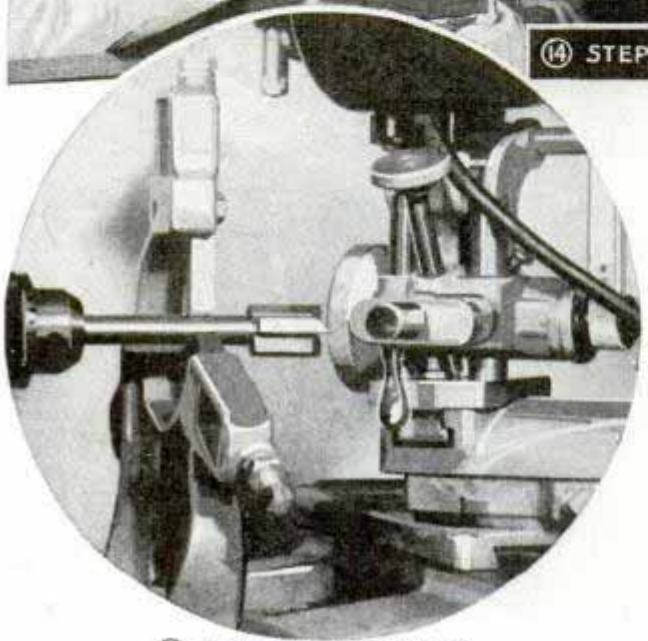


IMPROVISED FURNACE FOR HEATING SMALL REAMERS AND COUNTERBORES



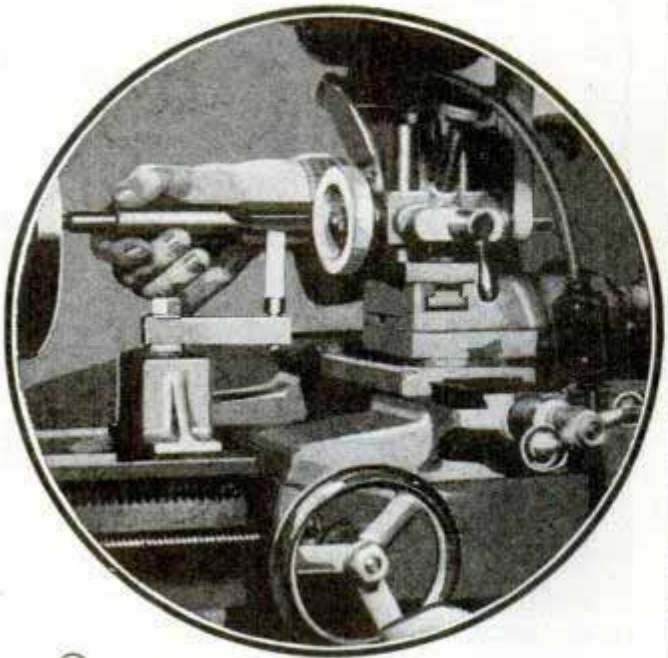
⑬ WORK SHOULD BE TURNED WHILE HEATING

⑭ STEPS IN GRINDING COUNTERBORES AND REAMERS



⑮ CLEARING END TEETH

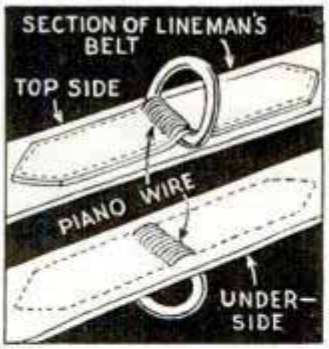
Counterbores are cylindrically ground the same as reamers, but lands resulting from the secondary clearance are not relieved. These tools do their cutting from the ends and one way of clearing the end teeth is by indexing from the headstock if possible, and using the steadyrest for forward support, Fig. 15. Indexing the flutes with the finger rest will give the same results. End teeth of counterbores also require a 5 to 7° clearance angle to sharp edges. Pilots can be made from cold-rolled steel and casehardened, Fig. 10. It is best to make the pilot .001 in. undersize, the stem being a medium press fit in the pilot hole. The fitting is done after completing the tool. The size and date of making are stamped on the tool before hardening. Electric etching pencils can be obtained inexpensively and are economical for a final touch. Be sure to keep your reamers sharp by grinding them regularly. Reamers and counterbores will last almost indefinitely as they need only be chromium-plated to size when worn.



⑯ CLEARING THE LANDS

⑰ FINISH-GRINDING THE SHANK

Wire Strengthens Hook Rings of Lineman's Safety Belt

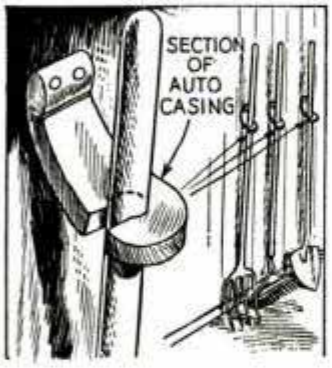


After experiencing a serious fall because the thread used in sewing the straps to attach the hook rings on his safety belt rotted and broke, a lineman now reinforces the rings with piano wire. This is stitched over the rings and through both the strap and belt as indicated. As a further precaution, the wire is renewed at intervals of two or three months.

Paper-Hangers' Brush Cleaned with Comb of Safety Razor

To clean paste from the bristles of his paper-hanging brush, one workman uses the comb of a safety razor, which quickly removes the dried paste, leaving the bristles flexible. If water is used to clean the brush, the bristles are likely to remain damp for some time and spoil the paper.

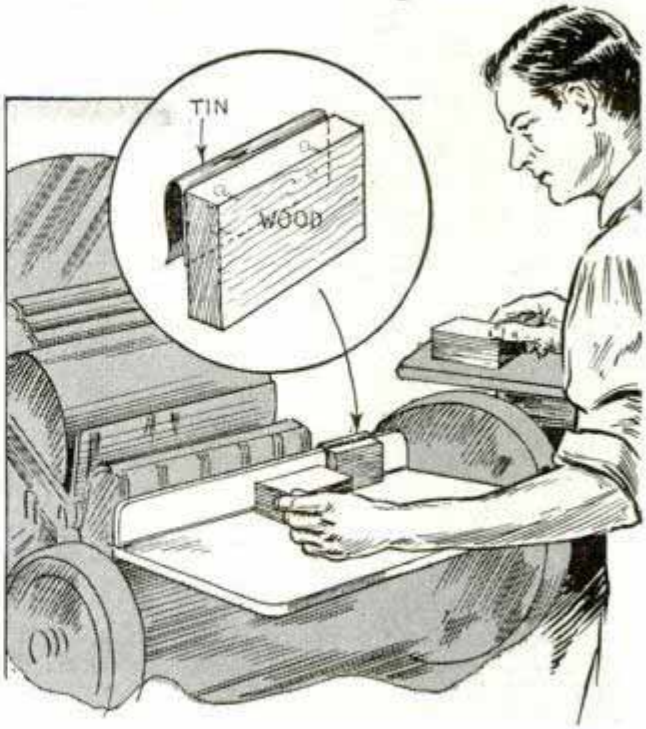
Long-Handled Tools Hung Up by Means of Rubber Holders



Sections cut from discarded auto casings and shaped as indicated will serve as excellent holders for shovels, pitchforks and other long-handled tools. The tool handles are easily inserted into the notches in the sides of the holders, which grip them securely.

¶Artists and others who work with water colors will find that a large-size medicine dropper is much better than a brush for transferring water to their mixing trays.

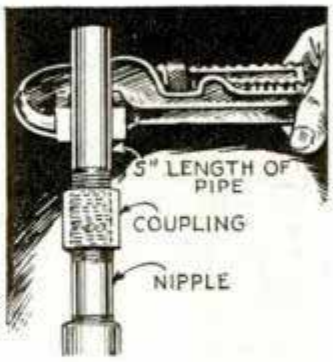
"Jog Block" on the Printing Press Aids in Stacking Cards



As an aid in stacking printed cards, for packing, as they are removed from the press, one printer uses a jog block. This is clipped over the delivery board, and as the cards are removed, they are given a flick with the finger to stack them against the block. This consists of a small block of wood to which a strip of heavy tin is tacked and bent to form a clamp.

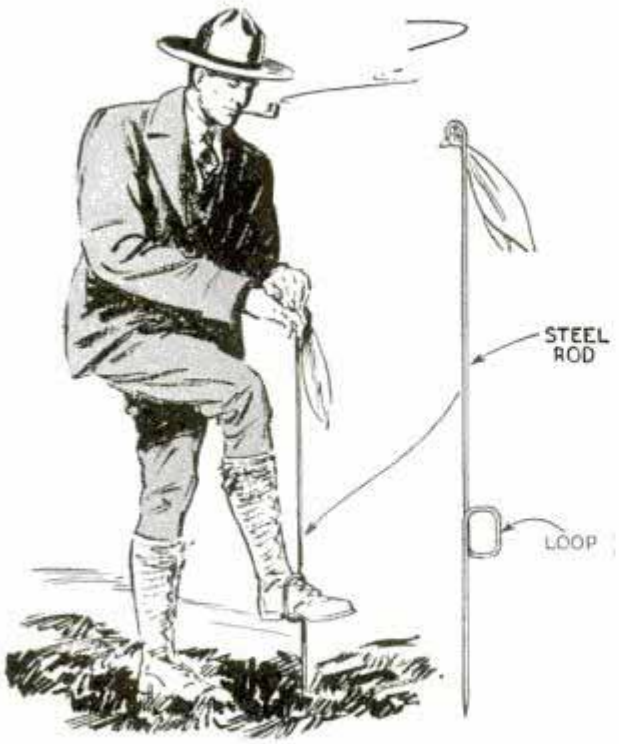
Removing Short Nipples

A short pipe nipple can be removed without ruining the threads or crushing it with a wrench, by the following method: Screw a coupling onto the end of the nipple and then screw a short length of pipe into the other end of the coupling until the ends of the pipe and nipple meet. To place the nipple, use wrenches on both the coupling and the short pipe. The assembly can be removed from the nipple by holding the coupling with one wrench and turning the short pipe with the other. To remove a nipple already screwed tightly in place, assemble the parts as before and use the wrench only on the coupling.



—Walter L. Andre, Cornell, Wis.

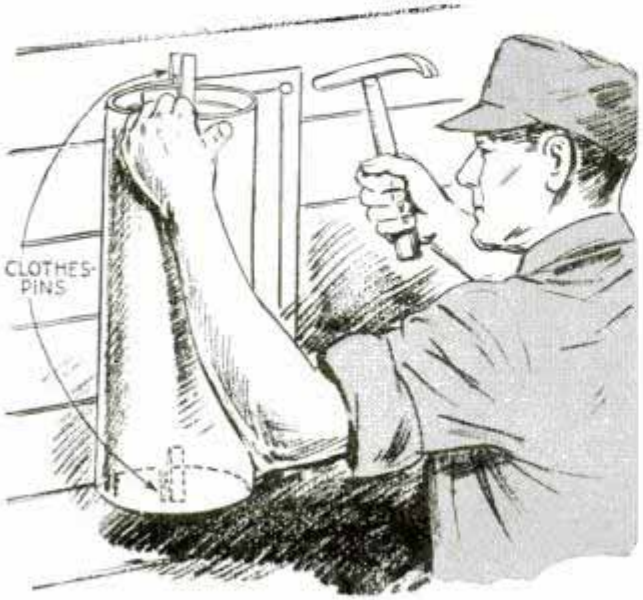
Surveyors' Stakes Driven Easily with the Foot



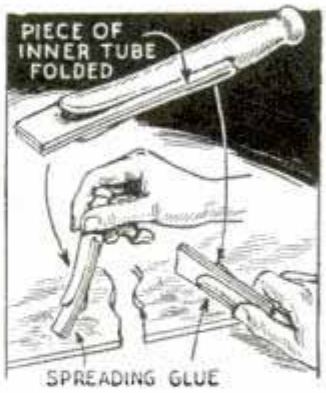
Surveyors who dislike carrying a hammer to drive leveling or marker stakes will find that steel rods with loops bent in them as indicated, are just the thing. To use them, insert the foot in the loop and push the stake into the ground.

Posters Rolled for Handling on Windy Days

When hanging cardboard signs and posters on windy days, one workman rolls each one to form a cylinder and fastens it with spring-type clothespins so that one edge is loose. When putting up the poster, the tacks are driven into the loose edge first, after which the clothespins are removed and the cylinder unrolled as the tacking progresses along the top and bottom.

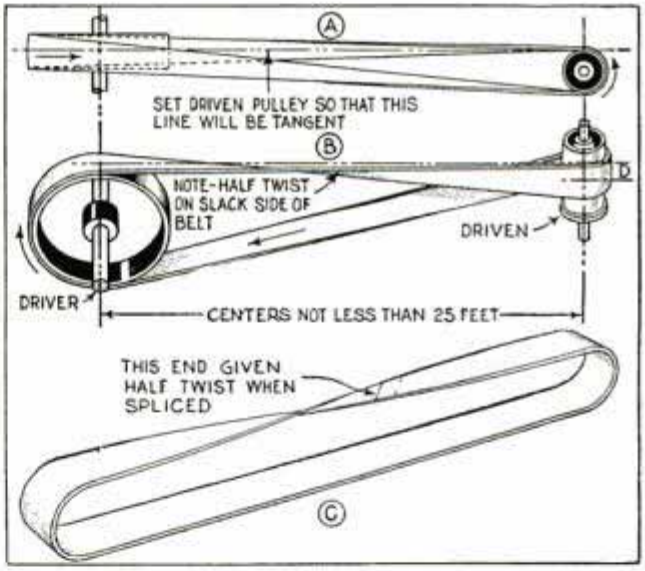


Glue Spreader from Clothespin



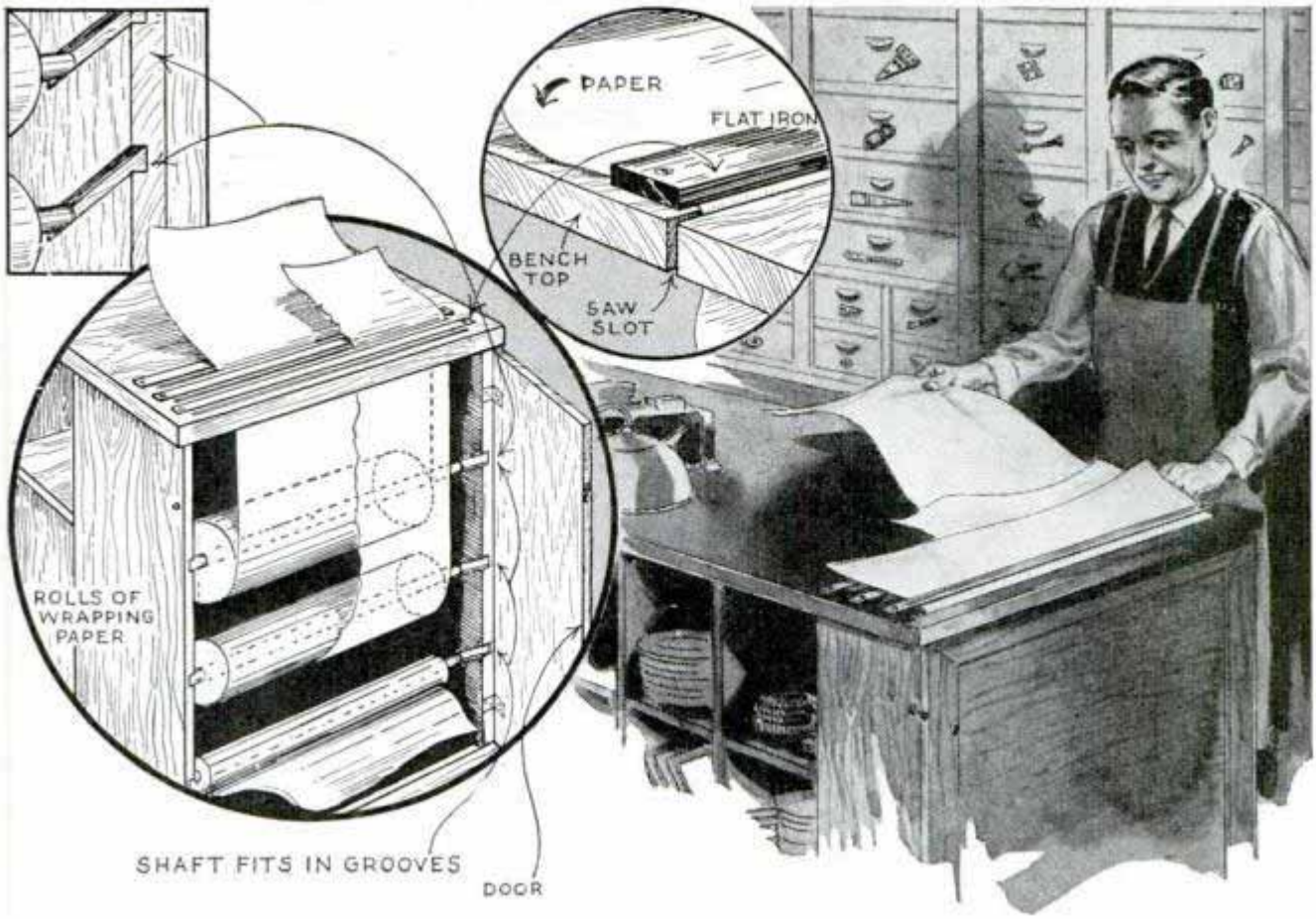
All you need for this simple glue spreader is a clothespin and a strip of old inner tube. Fold the strip in the center and push it into the slot of the clothespin, cutting the ends off so they project about ½ in. When applying glue to small surfaces the end of the spreader works best, while large areas may be covered quickly by using the side of the spreader.

Two Belt Kinks That Help



The tendency of a belt to sag, when driving a pulley on a vertical shaft with a large one on a horizontal shaft, such as deep-well-pump installations, can be taken care of by adjusting the center of the face of the vertical pulley so that it is lower than the top of the horizontal, as at A and D. The distance that the pulley is lowered should be equal to ⅛ in. for each foot of distance between the pulley shafts. In most installations, this should not be less than 25 ft. On belt drives of this type, the stretch of the belt will be uniform on both edges if it is given a half twist on the slack side, as at B and C. Without the twist, the belt will stretch along one edge.

Wrapping-Paper Rolls Kept under Counter



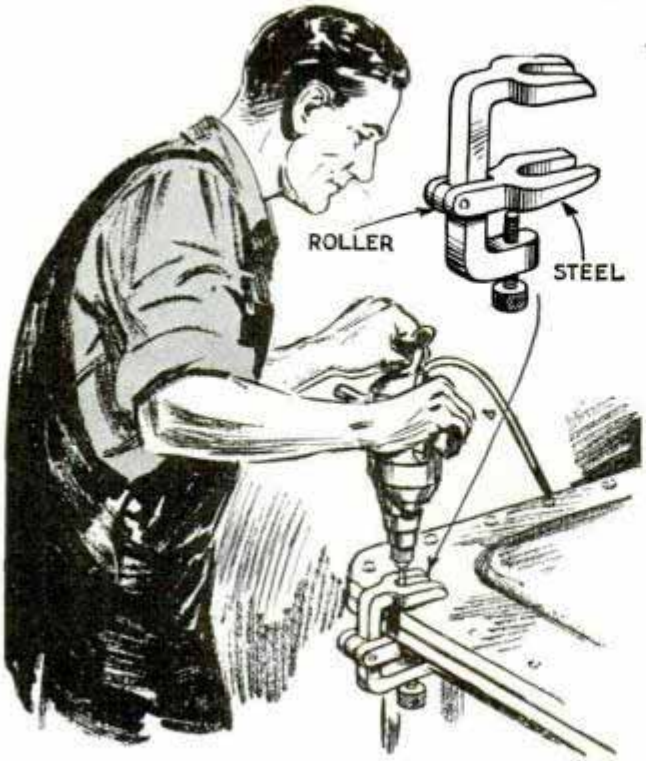
Instead of keeping rolls of wrapping paper on the counter, one merchant built a cabinet under the end of the counter to accommodate them. The cabinet has a plywood door which makes the interior accessible. The shafts on which the rolls are mounted slip into grooves cut into the sides of the box at an angle as shown, and the paper is fed through slots in the top of the counter from which it passes under strips of flat iron about ⅛ by 1 in. in size. The strips serve the double purpose of straightedges to aid in tearing the paper, and also as weights on the projecting ends of the paper to prevent them from slipping down into the box. It is best to have the holes in the ends of the strips a trifle larger than the screws that hold them in place, and the latter should not be driven down but should permit some vertical movement of the strips. Also, it is best to locate each strip about an inch or so from the slot so that the paper can be pushed with a finger of the left hand far enough past the tearing edge to enable one to pull the paper out for wrapping.—L. S. Flint, Boulder, Colo.

Oil-Burner Spray Jets Used on Grocer's Vegetable Rack

Here's a new slant on improvised spray jets for a fresh-vegetable rack used by grocers to keep the produce fresh and cool. Charles Schneiber of Lincoln, Nebr., built an elaborate vegetable rack with several innovations. Among them are spray jets obtained at a nominal cost from an oil-burner dealer. These were arranged in pairs and installed on standard pipe fittings. Drainage for surplus water is also provided and a fan provides air circulation.

If stove polish is moistened with vinegar instead of water, the stove will have a much brighter polish.

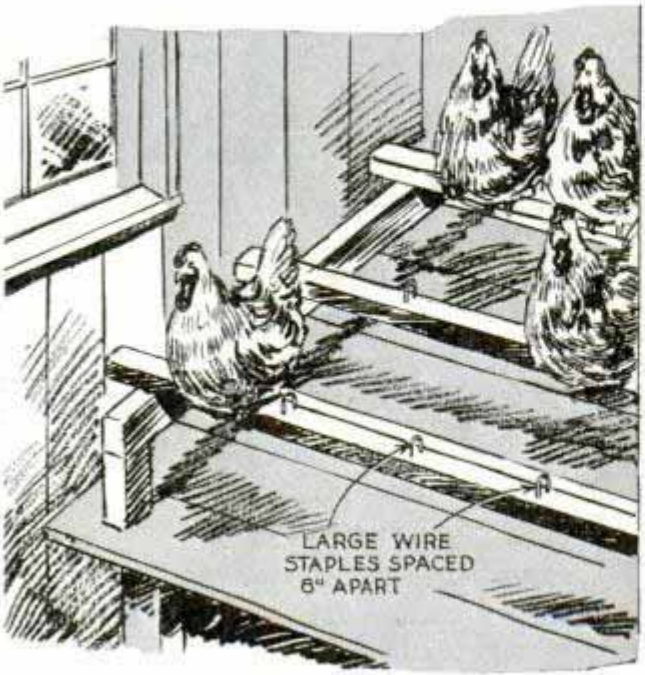
Slotted-Jaw Clamp Holds Work for Drilling



With this clamp, you can hold work together while drilling and be assured that the pieces are pressed tightly together where the hole is made, because slots in the jaws permit a drill to pass between them. The steel clamp is assembled easily, the movable jaw being fitted with a roller where it bears on the frame.

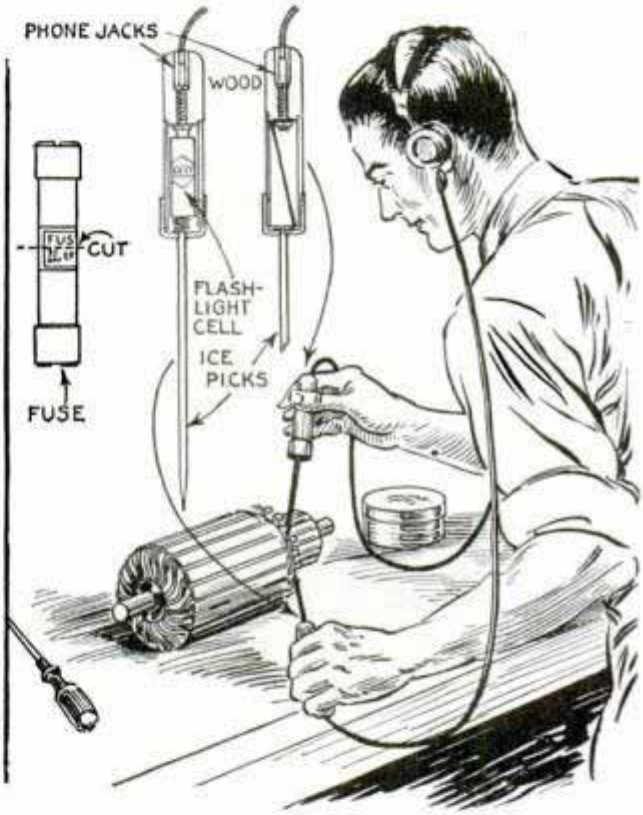
Staples in Roosts Prevent Hens from Crowding

A poultryman claims that crowding of hens on the roosts, especially when their feathers are wet with rain or snow, is apt to cause colds or roup. To prevent this, long wire staples are driven into the tops of the roosts. Each hen will settle down between two staples, which should be spaced about 8 in. apart.



Test Prods Have Self-Contained Current Supply

These test prods are unusual in that a flashlight cell is contained in one of them to supply the electric current when used in conjunction with a pair of headphones, thus dispensing with the usual connecting wires. The bodies of the prods are made from a 5-in. screw-cap fuse cut in half, and the points are made from ice picks.



The wood handles in the open ends of the fuse halves are pieces of broomstick whittled down to size. Jacks in the handles of the prods permit quick attachment of the phones. As shown, one jack is connected to the dry cell, which is in turn connected to the prod point by means of a coil spring. The jack in the other prod is connected to the point by means of a metal strip.

—Theodore Kropushek, St. Louis, Mo.

When drilling spring steel with a regular carbon steel drill, place a piece of flat iron under the work, instead of the usual wood block, and you will be less likely to break the drill.

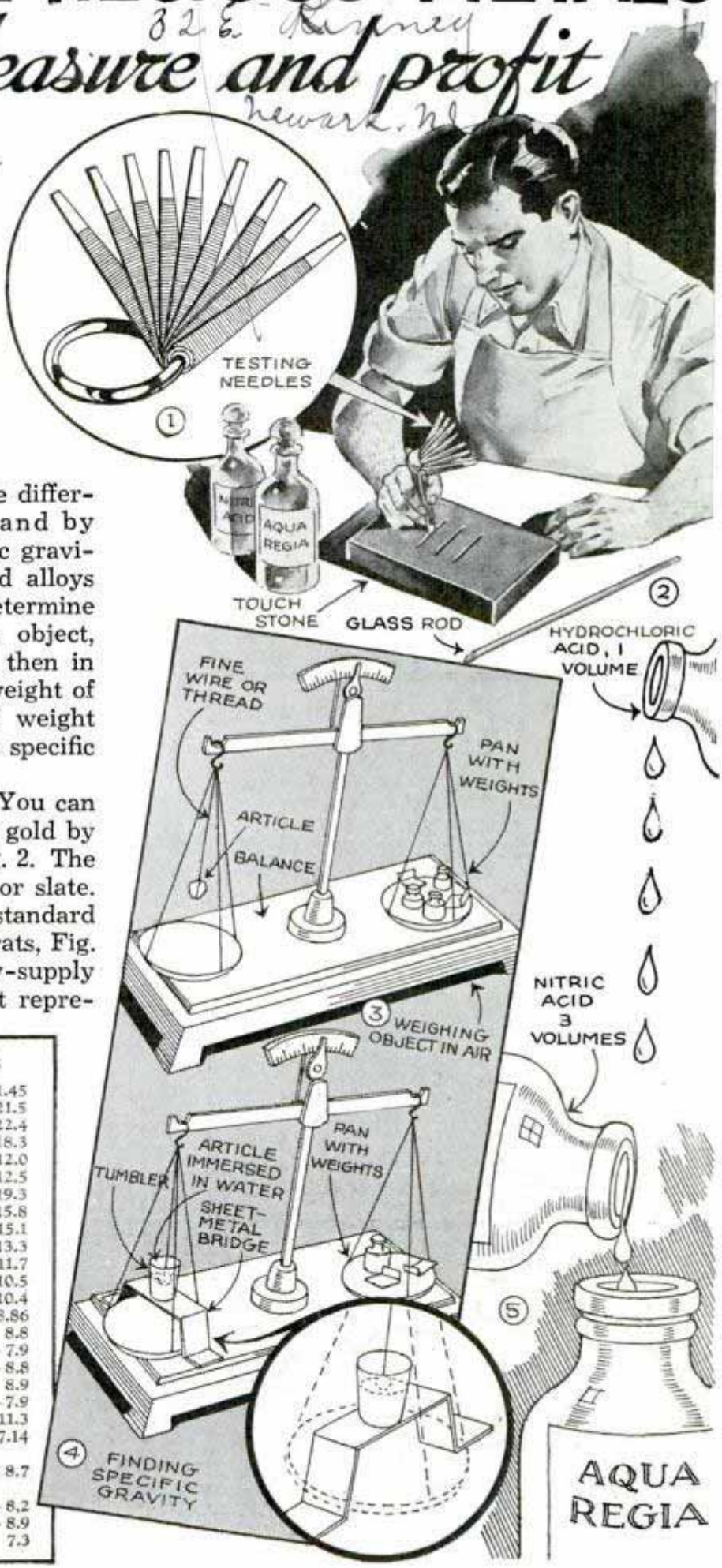
Detecting PRECIOUS METALS *for pleasure and profit*

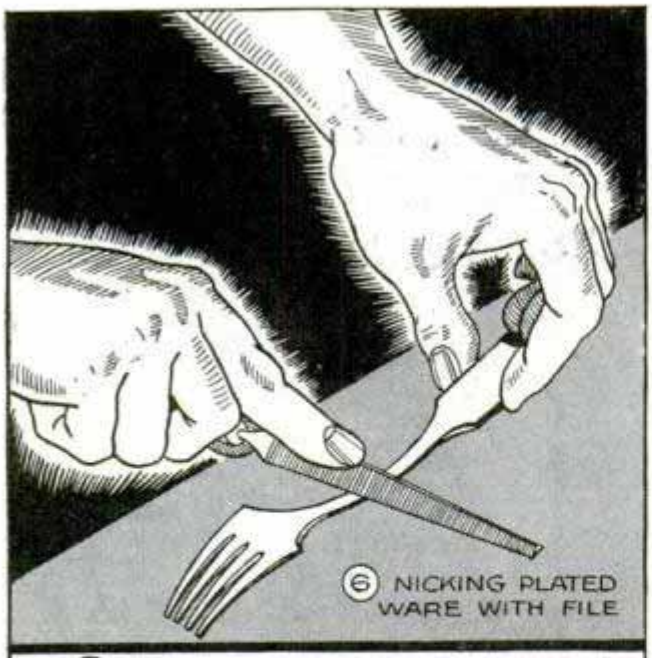
PROFIT can be made by collecting and selling scrap precious metal from old jewelry, silverware, dental work, etc. If you deal in gold, a government license is required, concerning which you can obtain information at a post office or federal reserve bank. Metals can be distinguished by the difference in specific gravity, and by chemical reactions. Specific gravities of common metals and alloys are given in Table I. To determine the specific gravity of an object, weigh it as in Fig. 3, and then in water, Fig. 4. Divide the weight of the object by the loss of weight when in water, which is its specific gravity.

Finding Karat of Gold: You can find the karat or purity of gold by the touchstone method, Fig. 2. The touchstone is black basalt or slate. The test requires a set of standard gold needles of various karats, Fig. 1, available from jewelry-supply houses. Twenty-four karat repre-

TABLE I—SPECIFIC GRAVITIES

Platinum	21.45
Platinum, 90%, iridium, 10%	21.5
Iridium	22.4
Platinum, 80%, palladium, 20%	18.3
Palladium	12.0
Rhodium	12.5
Gold (24 k.)	19.3
18 k. green	approx. 15.8
18 k. yellow	" 15.1
14 k. green	" 13.3
14 k. yellow	" 11.7
Silver (pure)	10.5
Sterling silver	10.3 - 10.4
Nickel	8.86
Monel metal (nickel—copper)	8.8
Stainless steel	7.7 - 7.9
Brass	approx. 8.4 - 8.8
Copper	8.9
Iron and steel	7.8 - 7.9
Lead	11.3
Zinc	7.14
German silver (nickel silver) (copper, zinc, nickel)	approx. 8.7
Aluminum bronze (dirigold) (copper, aluminum)	7.5 - 8.2
Bronze (copper, tin)	approx. 8.8 - 8.9
Tin	7.3





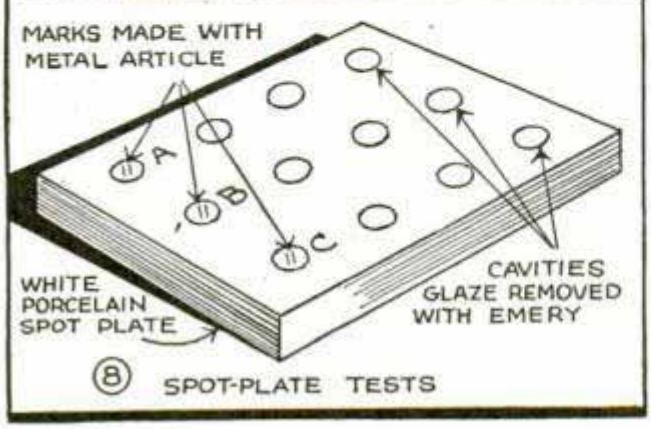
⑥ NICKING PLATED WARE WITH FILE

TEST "A," STANNOUS CHLORIDE SOLUTION, (STANNOUS CHLORIDE, ¼ OZ., IN WATER, 4 OZ., AND PURE TIN, ¼ OZ.). FOR GOLD, PLATINUM AND PALLADIUM

TEST "B," DIMETHYL GLYOXIME SOLUTION (DIMETHYL GLYOXIME, 15 GRAINS, IN WATER, 4 OZ.) FOR PALLADIUM

TEST "C," DISSOLVE TEST MARKS IN AQUA REGIA, ADD AMMONIA UNTIL ODOR PERSISTS, THEN TEST WITH DIMETHYL GLYOXIME SOLUTION FOR NICKEL

⑦



⑧ SPOT-PLATE TESTS

sents pure gold, and other karats indicate the proportion of gold to alloying metals. Thus, 14-k. gold is $^{14}/_{24}$ gold. To make the test, make a mark on the touchstone with the unknown object. On both sides of this mark make similar marks with two of the standard needles. Now touch each streak in turn, first with a drop of nitric acid and then with a drop of aqua regia. Aqua regia is made by adding one volume of concentrated c. p. nitric acid to three volumes of concentrated c. p. hydrochloric acid, Fig. 5. These acids are very corrosive to skin, cloth, and other substances. If spilled accidentally, wash immediately with plenty of water and neutralize with baking soda. Aqua regia spoils and should be fresh. By comparing the action of aqua regia on the streaks, the karat of the gold can be approximated. The rate that bubbles are formed, the color and appearance of the acid-treated streaks will correspond when the sample is of similar composition as the needles. If the metal does not match the first two needles, use two others. After use, the touchstone is rinsed off with water and any marks remaining removed with aqua regia. Yellow gold needles are not satisfactory for testing green and white gold; use green and white gold needles.

Gold jewelry runs from 10 to 18 karat, and dental work to 22 karat. Caution is needed in dealing with gold-filled, rolled gold, and gold-plated work. It has a surface finish of gold of high quality—but only on the surface. Often these pieces can be detected by the specific-gravity test. By filing the surface before making the touchstone test, to remove some of the plate, you can get a good idea of the interior. The filed spot can be touched with a drop of nitric acid (diluted if desired) on a glass rod. This will give a vigorous action with copper, brass, etc., but a slow action with gold of low karat, and no action if the gold is of very high purity.

Platinum and Platinum Metals: Platinum is generally found alloyed with either iridium or palladium. Platinum and its alloys can be identified partly by the touchstone method, using platinum and platinum-alloy needles and a white touchstone. Iridium-platinum and platinum marks on the stone will react slowly to aqua regia, but more rapidly if the stone is heated until uncomfortable to touch. The stone should be heated in hot water and then dried. Platinum-palladium alloys react

more rapidly with aqua regia. A chemical test for palladium usually identifies the alloy. The test solution is given in Fig. 7 B. Heat and filter the solution. The filtered solution is labeled and stored in a glass-stoppered bottle. Now make a mark on a spotting plate, Fig. 8, with a platinum needle, preferably one containing palladium. The glaze is removed from the plate with powdered emery. Dissolve this mark in a drop of aqua regia, and add a drop or two of dimethyl gyloxime. If palladium is present a yellow precipitate (solid) will form. If no palladium is present, the solution will remain clear.

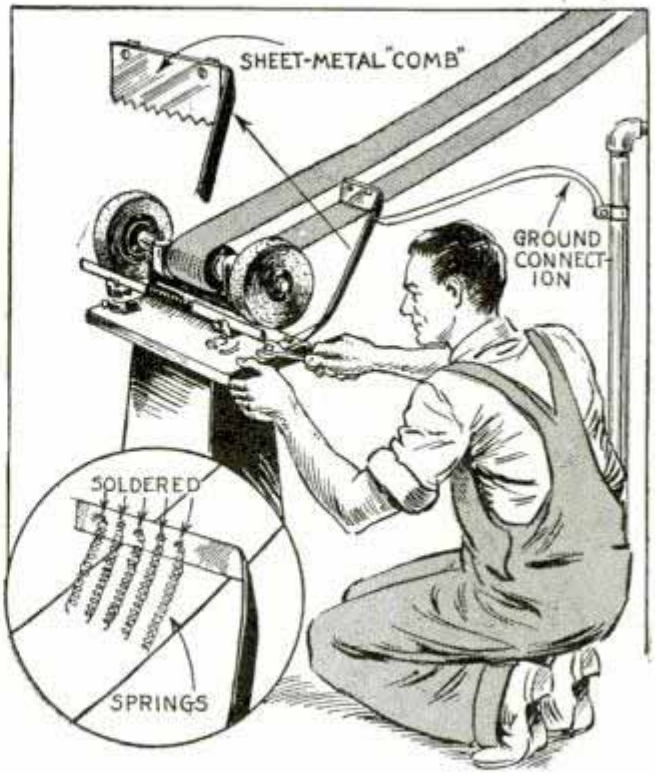
Distinguishing Platinum, Gold, and Palladium: As some white gold contains palladium, an additional testing solution given in Fig. 7 A is needed to distinguish gold and platinum. The solution is acidified by adding a few drops of concentrated c. p. hydrochloric acid. Make a mark on the spot plate with the metal under test, and dissolve it in a drop of aqua regia. Now add a drop of stannous chloride solution. If only platinum or platinum and iridium are present, a deep yellow or brown color will appear. If the solution of platinum in aqua regia is too concentrated, a black color will appear. In this case repeat, adding a drop or two of water before adding the stannous chloride solution. Platinum-iridium alloys dissolve slowly unless aqua regia is applied to a hot spot plate. Gold gives a deep purple, almost black, color, and leaves a purple stain on the plate. Palladium gives at first a yellow color, which changes to a blue-green.

Identifying Silver: Silver is soluble in nitric acid. If a crystal of common salt or a drop of hydrochloric acid is added to the solution of silver in nitric acid, a white, curdy precipitate forms. This turns purplish or black when exposed to light for some time.

Stainless Steel, Chromium, and Nickel: Stainless steel and chromium are rapidly affected by hydrochloric acid if heated slightly. Hydrochloric acid does not affect gold or platinum, and hardly affects silver. Nitric acid readily attacks silver and nickel, but not chromium, platinum, or gold. Nickel in white gold can be detected as indicated in Fig. 7 C. This will give a rose-red color if nickel is present .

All chemicals used must be pure and the glass rod should be washed thoroughly in distilled water each time it is used.

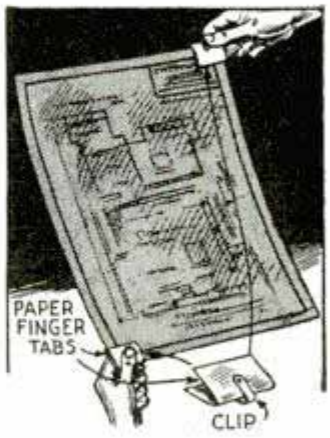
"Combing Off" Static Charges from Moving Belts



Static electricity generated on moving belts can be eliminated by the methods illustrated. A metal "comb" grounded to a cold-water pipe or to other satisfactory ground, is placed very close to the belt. If necessary, a comb can be placed adjacent to both faces of the belt. Where the slight discharge between the belt and comb would be objectionable, the comb should be replaced with a row of fine coil springs or light chains in contact with the belt.

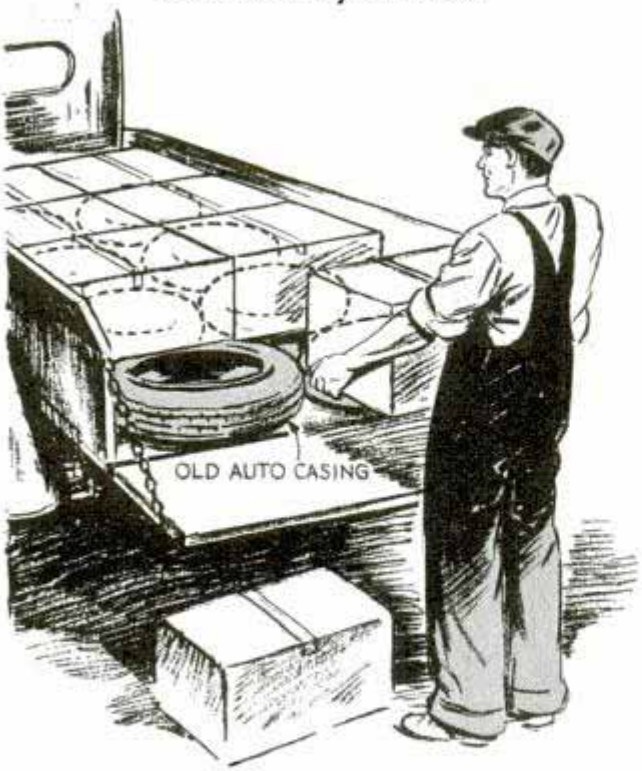
Finger Smudges on Blueprints Avoided with Paper Tabs

Annoyed by blueprints being soiled when handled by various workmen, a Wisconsin contractor attached paper tabs to the corners of the prints for handling them. The tabs are held firmly in place with paper clips of the type shown.



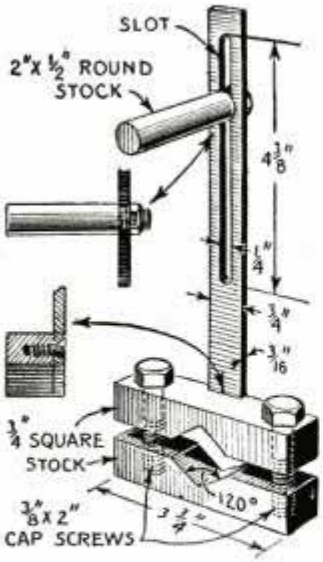
If you have occasion to use a drill that is too small to fit your brace, slip a piece of wire solder over the shank.

Old Tires Cushion Fragile Goods Hauled by Truck



When hauling fragile goods, such as eggs, fresh fruits, etc., that are likely to be damaged by vibration over rough roads, one truck driver sets them on old auto casings as indicated. The casings will absorb most of the vibration, especially if the treads are worn down so that the casings are quite flexible.

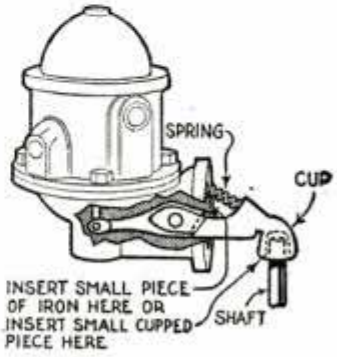
Gauge to Adjust Brake Shoes Assures Contact on Drums



This gauge or tool will be found just the thing for adjusting brake-shoe assemblies so that they contact the surface of the drum uniformly. It is made of iron or steel to the shape and size shown. For use on the front brakes, the gauge is clamped to the wheel spindle just so that it can be rotated. Then the adjustable arm of the gauge is set to the exact radius of the brake drum, after which the brake shoes are adjusted so that the arm will touch the lining uniformly as the gauge is rotated. When doing this, the brake pedal should be depressed a little so that the brakes will not drag when the drum is put in place. On the rear brakes where the axle shaft is tapered, the gauge can be used by pressing it against the housing with one hand while rotating it with the other one.

—Walter Klem, Irvington, N. J.

Taking Up Play in Fuel Pump Restores Proper Stroke

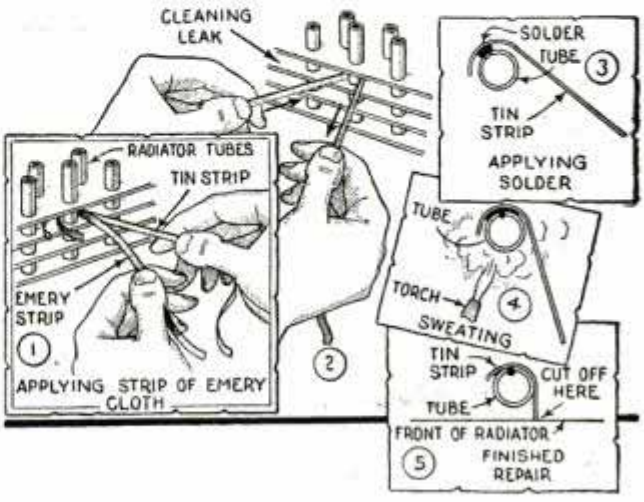


After a car has been driven several thousand miles, moving parts in the fuel pump sometimes wear so that the stroke is shortened and insufficient fuel is supplied to the carburetor. On many pumps, pieces of metal can be inserted at the places indicated on the drawing to compensate for the wear and restore the pump to its original stroke.

—C. D. Zaczkowski, New Britain, Conn.

Easy Repair for Radiator Tubes That Leak

Here is a method of soldering leaky radiator tubes that cannot be reached with an iron. After locating the leak, curve the end of a tin strip to the same contour as the tube. Insert the curved portion over the leak, and with it guide a strip of emery cloth around the tube. Then pull the cloth back and forth to clean the metal around the leak. Now remove the tin strip and melt a lump of solder so that it sticks to



the inside of the curved part. Again insert the strip and hold it so that the drop of solder is directly over the leak. Holding it firmly in place, apply a pointed flame to the tube and sweat solder the tin over the hole causing the leak. Let cool and then cut off the tin strip flush with the surface of the radiator core.

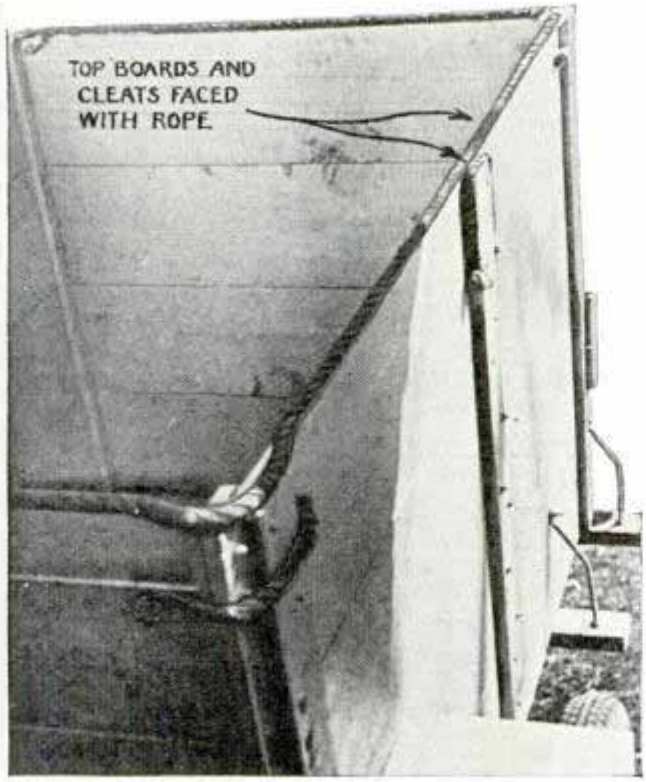
—W. C. Wilhite, Carlinville, Ill.

Air Hose Is Reinforced at Bends to Avoid Kinking and Breaking

Breaking of an air hose where it is bent repeatedly can be avoided by reinforcing these places with sections of garden hose. Select pieces of garden hose that will fit as tightly as possible over the air hose.

Rope Pads Horse Trailer

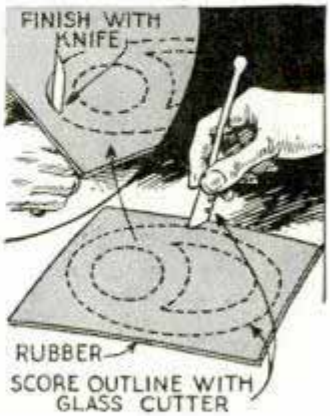
After finding that horses often injured their jaws on the top edges of a trailer in which they were transported, one farmer covered the edges with rope. This also was used to face all cleats and braces, to pad them. The rope was fastened in place with slender nails driven well into it.



Driver's Cushion Hangs on Seat When Not Being Used

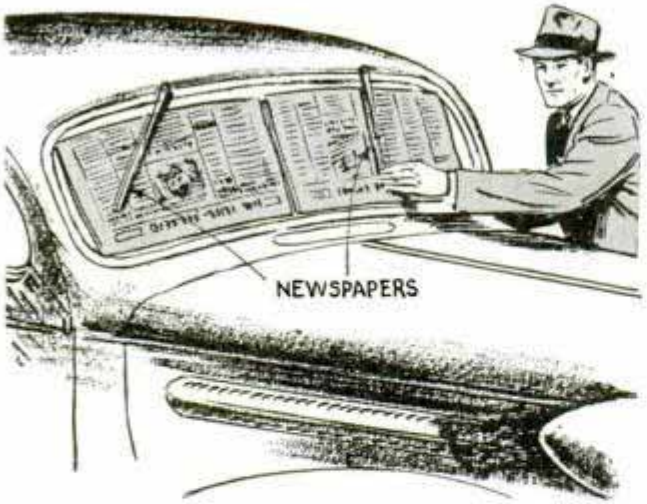
Motorists who drive cars that have individual front seats, and who employ an extra back cushion at times, will find that a pocket stitched to one side of the cushion makes it much handier. The pocket permits the cushion to be used in the regular way, and when not in use it can be slipped over the back of the seat out of the way. Also, the pocket keeps the cushion always conveniently at hand and covers the upholstery to protect it from soiling.

Glass Cutter Assures Accuracy in Making Rubber Gaskets



The difficulty of following an outline when cutting gaskets from rubber with a knife led one mechanic to try a glass cutter. With this, he was able to score the rubber accurately along the line to such depth that a sharp knife could then be employed to complete the work.—G. E. Hendrickson, Argyle, Wis.

Paper Keeps Frost Off Windshield of Parked Automobile



When you park your car outside on a frosty evening, place newspapers over the front of the windshield, slipping them under the windshield-wiper blades so that they will stay in place. Later in the evening when you use the car, the frost will all be on the papers so that you can remove them and drive away with a clear windshield.

—R. Rathlef, Nanaimo, B. C., Canada.

Trouser Cuffs Clipped to Avoid Soiling on Car Floor

Often the cuffs of one's trousers become dusty from contact with the floor of the car while driving. This can be avoided if you slip bicycle trouser guards over the cuffs as shown in the illustration. The clips will hold the trouser cuffs close to the ankles so they will not hang down and touch the floor.

What Kind of Boat Do You Want?

Whether it's a simple rowboat, an outboard runabout or a family cruiser, you'll find something you want among our blueprints. Build your boat now for the coming season:

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12-FT. ROWBOAT—707: Flat bottom. Can be used with small outboard motor. 25c.

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16-FT. CANOE—811 and 812: Cedar planking covered with canvas. Two prints 50c.

CANVAS-COVERED KAYAK—928 and 929: Light framework covered with canvas. 17 ft. in length and accommodates single passenger. Two prints 50c.

Any six of these plans (not projects) will be sent postpaid upon receipt of $1.00

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Testing the Roads of the Future

(Continued from page 573)

—the weight of traffic standing still. Radiating from the point where the load is applied are pegs fitted into holes drilled in the pavement. Strain gauges detect the slightest movement of the concrete and contribute data that will tell road builders what load a given pavement will support.

Elsewhere on the same road a wheel bounces up and down to deliver impact force, producing the effect of moving traffic. Automatically the wheel is lifted and dropped, gradually changing the concrete beneath it, as gauges record the damage.

This government bureau extends its service across the country as a section of an actual road is received at the laboratories for testing. Facts are known about the history of this road, but what will its future be? A giant circular saw with carborundum teeth cuts the concrete into uniform pieces. A powerful drill bores cylinders of identical size. The specimens are crushed in hydraulic presses, pulled apart to learn tensile strength. Instruments show what pressure crushes the concrete, what force bends or breaks it. Analysis of these results forecasts the future of the road, tells what maintenance will be needed, when the road will have to be replaced.

Special trucks and trailers, fitted with precision instruments, take to the road to bring back information that will confirm or refute a theory. A truck chassis carries a delicate mechanism to record the force with which the wheels strike the pavement. By estimating how many such trucks may be expected to roll along a road in a given period, engineers can compute how much damage the trucks will do.

There is a machine, called a roughometer—a one-wheel trailer equipped with apparatus—that registers the bumpiness of a road. Bumps are translated into standardized degrees of roughness, and with this "fifth wheel" roads a thousand miles apart can be compared accurately and easily.

Steel balls and samples of brick are placed in a rattler—a kind of mangle. The machine is whirled violently with a deafening clatter. When the bricks are removed after turning a certain number of revolutions, their ability to withstand this beating determines their value for paving purposes. Curing in the sun are slabs of concrete. Signs tell what mix was used, the kind of reinforcing steel, the distance between joints. Periodically the surfaces are checked to note the effects of time and the elements.

Government engineers have ways of speeding up time. Freezing and thawing will weaken a roadway. So concrete guinea pigs are placed in a cold chamber, coated with ice, and thawed. A weatherometer turns on the heat of several month's sunshine in a few hours. Thus road builders may know in advance how a pavement will react to onslaughts of the weather.

It also is important to delve beneath the surface and study the subgrade, the soil that supports the highway. At a proposed road site, drills bring up samples of soil in undisturbed strata. These tubular-shaped specimens are sent to the laboratory for analysis. Here electrically vibrated sieves separate the sand from the silt and clay particles. An ordinary soda-fountain mixer whips the silt, clay, and added water into a saturated solution which is placed in a glass jar. The speed with which the particles settle shows how much of each the sample contains. And the proportions of sand, silt, and clay tell how well the soil will support a road.

Scientific divining rods to locate bedrock beneath the surface of the ground have been invented at this government bureau. One of these fascinating gadgets points to the presence of subterranean rock ledges by using the earth as a conductor of electricity and recording resistivity with electrodes spaced at various distances. Another creates a small earthquake with a charge of dynamite and employs a sort of seismograph to note the earth's ability to transmit the tremor.

When satisfactory apparatus does not exist ready-made for some experiment, the research men must create it. Many of the devices used at the division of tests were planned, built and perfected in its own machine shop. Some of the equipment has met existing needs so well that it is now manufactured commercially.

¶Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

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Step Savers for Millions

(Continued from page 527)

but prepared to retard speed when you near your destination. The car speeds along at a rate proportional to the voltage. Voltage is gradually built up in the generator. Finally the car enters the slow-down zone of your floor. Magnetic iron plates in the shaftway send impulses to the selector, they energize a contact, and deceleration begins. Relays click. The car draws up smoothly flush with the landing.

Automatic self-leveling is assured even though your car, operated by a 100-horsepower motor and supported by cables holding up to fifteen tons of equipment, may be subject to a cable stretch of four or five inches. Vigilant photoelectric cells in the shaftway compensate for this stretch by moving the car to a true level with the landing.

Other photoelectric cells protect you when you enter or leave the car. The Safe-T-Ray, a beam of light trained on an electric eye in the shaftway opening, waits until you and your fellow passengers have crossed the threshold before permitting the doors to close.

Until 1921, hydraulic elevators were the most commonly used. They were set on a plunger going as deep into the ground as the building was high. Since the early 'twenties variable voltages or similar controls have gone into the manufacture of high-speed electric elevators everywhere. Speeds up to 1,400 feet a minute are easily attained. Higher rates are possible.

Comparable with the single-geared motor of the apartment-house elevator is the driving machine of the electric stairway, which also has a phosphor-bronze gear. Service brakes are also similar, and a push-button controller of the electromagnetic type functions as starting equipment. The electric stairway has made rapid progress in recent years and today it saves the public some 20,000,000 steps a day.

An electric stairway is an electrically propelled series of steps secured to two endless chains and rolling along a track structure. The main driving unit consists of a torque assembly mounted on a stationary shaft. Included in the torque assembly are a chain, chain drive, hand-rail sprockets, and emergency brake.

Longest in the nation is the one in the Theme building at the World's Fair, which is 120 feet long, and has a vertical rise of sixty feet at a speed of ninety feet a minute.

The spectator conveyor in the General Motors Futurama at the World's Fair, built by the Westinghouse Electric Elevator company, is 1,600 feet long, travels at 100 feet per minute, and carries 2,000 people an hour. Platforms on which the public is carried have double chairs.

The electric stairway goes back to 1900, when it was demonstrated for the first time at the Paris Exposition. But the elevator was known to the ancient Greeks. Archimedes, the mathematician, invented the first passenger elevator, a manually operated overhead drum type, in 236 B.C. The Egyptians are believed to have been the first users of freight lifts, having manipulated pulleys and windlasses in building the pyramids. In the 1850s, with the application of steam engines as rotating equipment for lifting apparatus, the devices of Elisha Graves Otis, outstanding pioneer in the industry, and Otis Tufts, received considerable acceptance. Mr. Tufts installed the first vertical screw elevator in New York's Fifth Avenue hotel. A cast-iron screw extended the height of the shaft and turned into a nut in the floor of the car.

There are 220,000 elevators of various types in use in this country today, but in spite of the results accomplished thus far, engineers continue to seek improvements. In the testing tower of the Westinghouse Works, a robot car moves up and down twenty-four hours a day, six months at a time, its relays performing 25,000,000 operations. Such tests are the equivalent of a quarter century of elevator service. Equally severe are the trials which all new improvements undergo.

Coke from Charcoal and Tar Has High Carbon Content

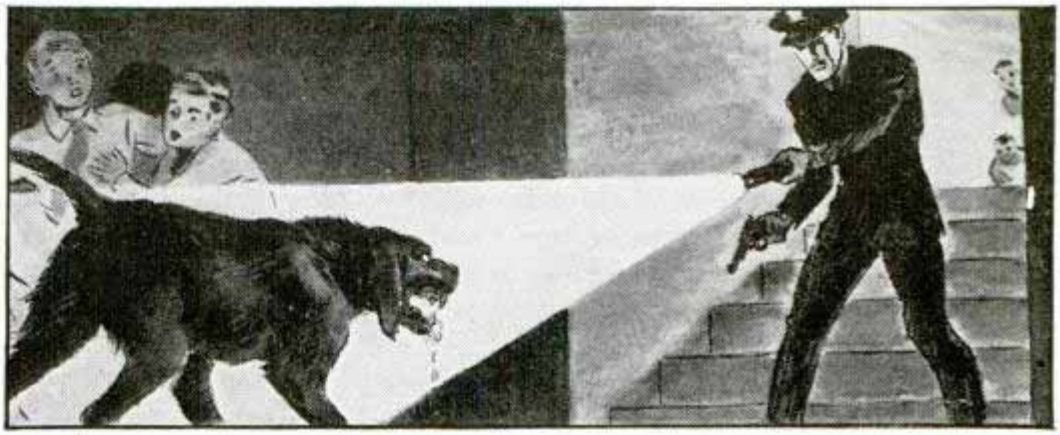
Wood charcoal plus tar can be converted into coke by a process just developed. The resultant coke is about ninety-five per cent carbon, while coke made from coal is only eighty-two per cent pure carbon. The use of sawdust, slabs and low-grade timber to make high-grade coke may open a new market for otherwise waste wood.

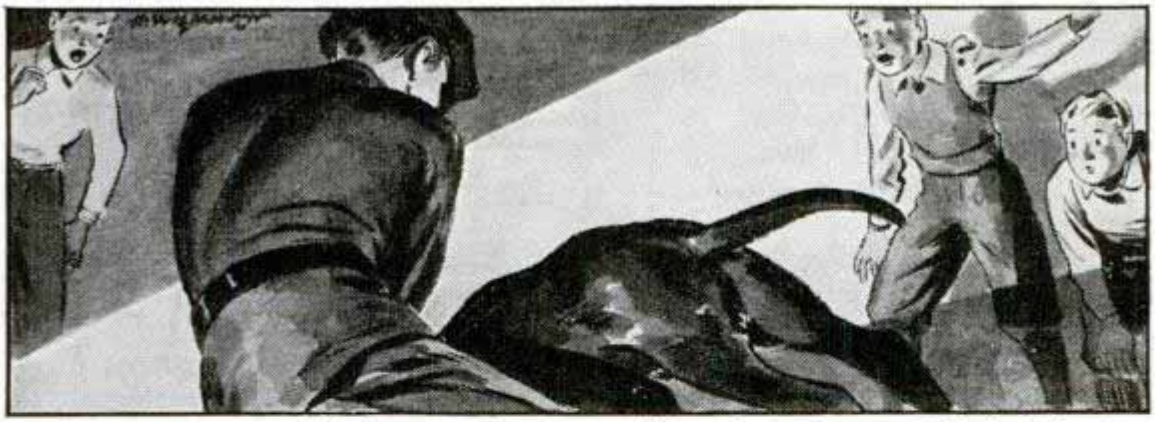
"FANGS BARED, THE CRAZED BRUTE CROUCHED TO LEAP"

A true experience of JACK HARRIS, *Police Officer, Philadelphia, Pa.*

"'MAD DOG ON RAMPAGE . . . Red Car No. 77,' our police radio blared," writes Officer Harris. "In a matter of seconds, we screeched to a stop at the scene of the trouble—a school yard in which 1200 boys milled about in panic. Seven of them had already been bitten.

"I CHASED the frothing brute* into the eerie gloom of a basement corridor in the school. Then suddenly he turned, crazed and snarling, crouched to spring at my throat. I couldn't shoot because of the youngsters—so I aimed the blinding beam of my flashlight straight into his eyes...





"THEN I SPRANG at *his* throat! After a terrifying five minutes I choked the 95-pound horror into unconsciousness. You can take it from me that 'Eveready' *fresh* DATED batteries are a cop's best friend. They're always dependable—always ready to get you out of a jam! *(Signed)* Jack Harris"

***DOG LOVERS: Not running fits, an authenticated case of rabies.**

The word "Eveready" is a registered trade-mark of National Carbon Co., Inc.

FRESH BATTERIES LAST LONGER... *Look for the* DATE-LINE

NATIONAL CARBON COMPANY, INC., 30 EAST 42nd STREET, NEW YORK, N. Y.

Unit of Union Carbide UCC *and Carbon Corporation*

Champions in the Making

(Continued from page 523)

hit-and-run play is about to be attempted. The weaknesses of the different batters are studied constantly.

The first baseman learns that he always should keep the runner in view. To do this he is drilled in turning to the right when tagging runners, thus always facing the diamond. He is taught to stand slightly in front of the bag, feet straddling the base. Then, when he sees the direction from which the throw is coming, he puts the correct foot on the bag, thus keeping his legs from getting crossed. He strives to make his throws effective, so that when he takes part in a double play his first throw will be good. Accuracy in this respect, rather than speed, is drilled into him. As Fonseca says, "Retiring the first man will still save the old ball game."

A good second baseman has to have a speedy snap underhand throw, for getting rid of the ball in a hurry and putting out runners. The second baseman usually works on a scant margin of time, and he develops his underhand throw to insure fast, accurate ability that often means saving a tight game.

Teamwork between the shortstop and the second baseman is developed. If the shortstop fields a ball toward third base, he is schooled to brace himself on his right foot and to straighten up for the throw, to give the ball speed. If he fields a hard-hit ground ball, he finds it best to get in front of the ball, stop it, then straighten up for an accurate, fast throw. If it is a slow grounder, he learns to field it "offside," and to throw it from the crouching position in which he fields it, to save time.

On the "hot corner" the third baseman finds he must share duties with the shortstop, so he doesn't play too close to the bag. For a possible sacrifice he stations himself well in front of third base. For right-hand hitters he finds it best to stand about ten feet back of the base, and well away from it, except in the case of a dead left-field hitter who is likely to drive down the base line. In this case he moves a couple of steps, or about six feet, closer to the foul line, and he comes in closer to the bag in case of a left-handed hitter, to help offset the advantage that such a batter has in being on the first-base side of the plate, which shortens the distance he must run to first base by several feet.

The outfielders are taught to keep in back of fly balls, coming in to make the catch. They, too, spot themselves in the field according to the batting characteristics of the hitter, and they make every effort to catch fly balls near or above the shoulders. This saves time on return throws.

Base running comes in for its share of attention. Players are taught to touch the inside of the base with the left foot, and to take it in their stride, so that they will not slow down in their running.

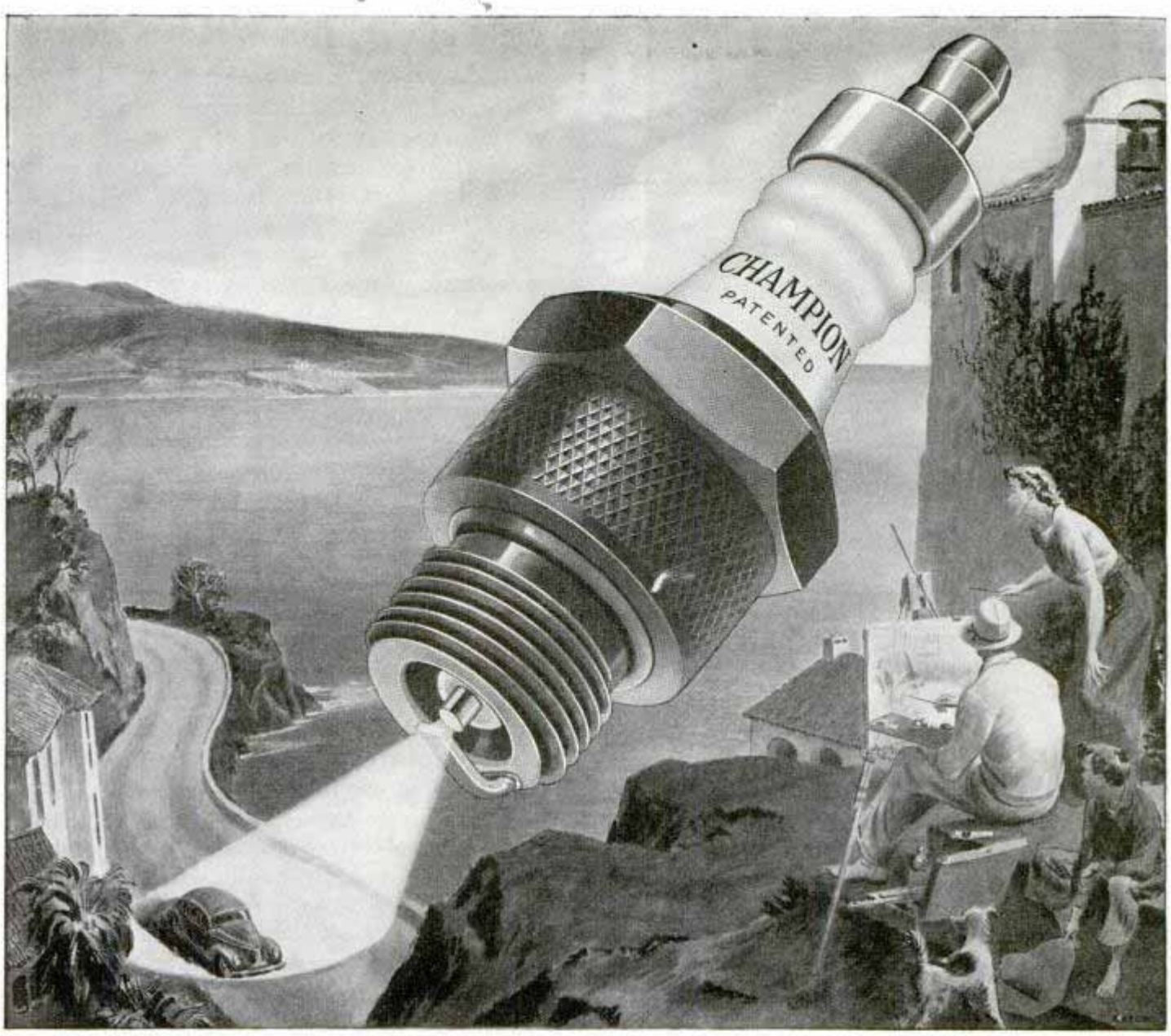
Bunting is a logical procedure to advance runners to second or third base, and the player gets practice in this sacrificial bit of the national pastime. He may use the open stance in standing at the plate, shifting his feet to a closed position, with the left a little ahead of the right, or he may take the closed stance immediately. He learns to avoid trying to bunt high fast balls, since they tend to pop up into the air. The bat, he finds, is best kept well out in front, the grip loose, the hands apart, and the bat level with the ground.

In the training camps the old-timers refresh their memories and drill themselves in the things that past seasons have taught them. For the rookie the training camp is a "prep school," and if he has come direct from the sand lots or a college team, the camp teaches him things that the minor-league training he has missed would have taught him. At the spring camp the rookie often has to redefine his understanding of some things, such as the fact that a big-league pitcher, when he cuts the corner of the plate, really cuts the corner. He doesn't cleave the plate in half.

Come the end of the camps, and the exhibition games in the vicinity, and the teams head north to open the regular season. Then the opening day, the bands play, crowds flow in at the gates, opening day ceremonies take place, and the call to action as the umpire barks:

"Play ball!"

¶Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.



ENJOY MOTORING TO FAR PLACES WITH NEW CHAMPION SPARK PLUGS!

Champion Spark Plugs are engineered to make your car perform to the limit of its ability—to re-vitalize every cylinder so that you can depend on quick starts, fast, smooth acceleration, and full, flowing power and speed.

This is particularly true of Champions since the development of the exclusive Sillment seal. Since compression leakage in spark plugs materially alters their individual heat range and noticeably affects the efficiency of modern high compression engines, it can be readily seen that Champions' leakproof qualities are vital to top-notch performance and economy.

Insist on Champions. For greatest engine efficiency have your spark plugs tested and cleaned regularly and replaced every 10,000 miles. Pick up and go with new Champions.

ACTUAL SIZE V-PLUG

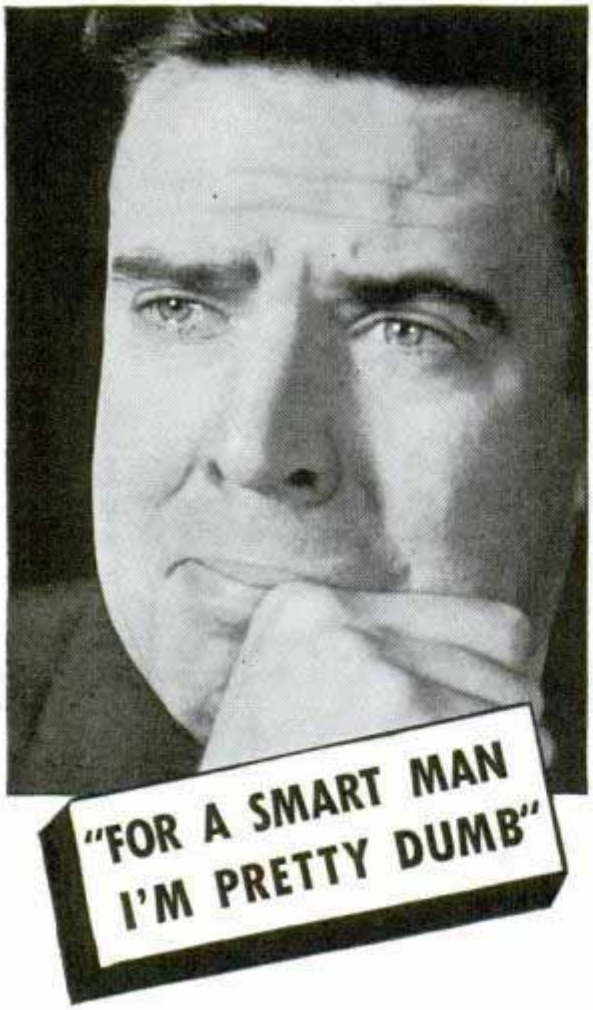
65c

MODEL BUILDERS—ATTENTION!

Champion has designed 3 spark plugs for model gas engines which give the same dependable performance as the regular spark plugs. Sillment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

	V	V-2	V-3
Hex	½"	⅜"	5/16"
Thread	⅜"-24	¼"-32	¼"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3½	2½

CHAMPION SPARK PLUG CO.
900 Upton Ave.
Toledo • Ohio



"I never realized this until too late—every fire insurance policy states that a complete list of destroyed and damaged property must be supplied before insurance can be paid. I had insurance, but the fire we had caught me way off base. It's too late now to make a complete list for insurance settlement.

"It would have been easy for me or my wife to make that list *before* we had a fire. There's even a helpful booklet that lists things, room by room, and helps you remember articles that you might forget. The book is free. I hope other families will be smarter than we were and get one of these books before it's too late!"

MAIL THE COUPON

THE AMERICAN INSURANCE GROUP (Dept. 2815)
15 Washington St.
Newark, N. J.

Without charge or obligation, please send me your Household Inventory Booklet.

*Name*_____

*Street*_____

*City*_____ *State*_____

Fighting Crime by Remote Control

(Continued from page 565)

states, police organizations are being welded into one smooth-functioning ring by networks of electric typewriter circuits covering 125,000 square miles in which 35,000,000 reside. Let's see what happens when three men hold up a jewelry store in upstate New York. As soon as word reaches the town's law-enforcement agency, an officer punches on his Teletypewriter the following message:

JEWELRY STORE HERE HELD UP A FEW MINUTES AGO MEN ESCAPED WITH $5,000 CASH AND $1,000 JEWELS USED MAROON COUPE HEADED SOUTH

Instantly police typewriters in hundreds of cities and towns throughout New York and adjacent states spell out the details of the robbery. State troopers, sheriffs, and metropolitan traffic, squad car, and motorcycle details start checking the streets and highways. Cars are stopped and occupants who appear to fit the description of the holdup men are questioned.

Police Teletypewriter hook-ups have grown from a single circuit of Connecticut municipalities to the point where the system now embraces New York, New Jersey, Massachusetts, Rhode Island, and parts of Maryland, Delaware, and New Hampshire. California and the major cities of the Middle West have fitted equipment of this type into their communications systems. The records of the New Jersey state police show in one year criminals were apprehended or stolen property was recovered in 1,376 cases through information sent out by Teletype. By means of the "eight state alarm" comprising the states enumerated above with the exception of Maryland, police in one city can communicate with the police in 350 other communities day or night. The printed alarms thus distributed to these fixed points can be radioed immediately to prowl cars, police booths and other points. Thus, a stolen-car alarm can be made known to detectives, patrolmen, motor-vehicle bureaus, and troopers throughout the chain of states within fifteen minutes or less. And the Teletypewriter exchange service is set up to link the police with Washington so that they can send or receive communications from the Federal Bureau of Investigation.

John made $42.50 in one day in his NEW Business

● Get Into This Business Now—

a business which is so new that it is practically without competition. This should enable you to make really BIG MONEY. Hotels, homes, clubs, office buildings offer tremendous possibilities. Our new DETERGER washes upholstered furniture, electrically right in your customer's home, with a new soapless soap whipped into DRY suds. *No liquid touches the fabric*, therefore the furniture is ready for use soon after cleaning. We have helped hundreds of men get into business for themselves with our automatic equipment. The U. S. Government and many of the world's largest hotels use our machines.

Make Money the FIRST DAY

The Deterger is ready to use when you receive it, so you ought to be taking in big profits the first day. We want an honest, ambitious man in every locality. If you are that man we will help you get started for yourself in a business with tremendous possibilities.

No Rent to Pay You don't have to rent a shop. You don't have to hire a building, for you do the work right in your customer's home. You save the expense of carting furniture back and forth to a central plant; the owner's home is your workshop.

J. S. Corson says

"I cleaned seven living room sets and fourteen chairs, as well as twenty-five automobile interiors the very first month and made $279.50." Berger Hanson wrote "My investment in your DETERGER was the wisest I have ever made. It is my most valued asset." Barrett says: "Made $28.00 in eight hours, on another job made $11.00 in two and one-half hours." Alex Gulkin's business expanded so fast that he already has SIX DETERGERS making money for him.

No liquid touches the fabric when cleaning with the DETERGER.

Pay as you Earn

Only a limited amount of money is needed for a down payment. The balance you send on easy terms. Most men find it possible to make far more than the cost of the machine before the payments come due. Every machine is fully GUARANTEED and satisfied customers send their friends to you.

Book sent FREE

Write today for copy of our booklet, **"Your Own Business, Profits Instead of Wages."** Let us tell you how easy it is to get started in a year around business where you are your own Boss and can stop worrying about just a job. Write today—NOW.

VON SCHRADER MFG. CO., 554 Pl., Racine, Wis.

VON SCHRADER MFG. CO., 554 Pl., Racine, Wis.

Send me (without obligation) your free booklet telling me how I can own my own business and become financially independent and how I can pay for the DETERGER on easy terms.

Name.....

Address.....

City.....State.....

NEW TURN SIGNAL

FLASHES from REAR WINDOW—DASH Control

AGENTS A whirlwind seller. Drivers buy on flash demonstration. Dealers buy 3 to 12. Your profit mark-up as high as 264%. Biggest sensation of year. Rush name quick for facts and Demonstrator sample plan. All Free! Rush.

WATCH-MY-TURN SIGNAL CO., Dept. W-164, Walnut Bldg., Des Moines, Iowa

LIGHTS ITSELF

SELLS ITSELF

Quick Action (1940) Perfected Self Starting Lighter

Lights cigar, cigarette or pipe—instantly. Never fails. Improved principle in ignition. No flint. No friction.

Send 25c for sample and large can of fluid

Agents report big earnings

NEW METHOD MFG. CO.

Mfgrs. Of No Flint Automatic Gas Lighters

Box PMD-88, Bradford, Pa., U. S. A.

25c RETAIL

DOZ ... $1.75

GROSS . $18.00

CLAMPS

The biggest need in most home workshops is more good clamps—clamps for gluing, holding, drawing-up and for setting-up work. They are the extra hands for the 1-man shop. Don't spoil or delay work for want of clamps. From over 40 types of clamps we have selected these as the first for homecraft use.

ADJUSTABLE CLAMP CO.

"The Clamp Folks"

421 N. Ashland Ave., Chicago, U. S. A.

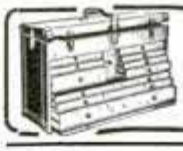
Jorgensen Handscrews

Genuine "Jorgensen" Handscrews grip at all angles, never slip, split or loosen. All sizes. Send $3.20 plus postage (7 lbs.) for 2 No.1. Handscrews—open 6".

PONY Miniatures 9 types 1" to 2½" cap. Not toys but fine tools with 100 uses.

PONY "50" Fittings go on ordinary ¾" pipe. Any length. Send $3.00 plus postage (6 lbs.) for fittings for two "50" Clamps. Also "Pony" No. 52 Fittings for ½" pipe—2 sets for $2.00 plus postage.

Catalog FREE Ask your Dealer



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are better, finer, and more desirable for the good tools of Machinists and Toolmakers. Free Catalog.

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440 Columbia St. Dayton, Ohio

WORLD FAMOUS • STANDARD MAKE

TYPEWRITERS

as Low as $26.90

10 DAY TRIAL

No Money Down

EASY TERMS as low as 50¢ a week

YOUR CHOICE—UNDERWOODS! ROYALS! REMINGTONS! L. C. SMITHS! WOODSTOCKS! As low as 1/3 mfrs. original price. Typewriters that cost up to $110.00—some as low as $26.90. Genuine, standard, full sized rebuilt office models—up-to-date improvements—standard keyboard, back spacer, ribbon reverse, 2 color ribbon, etc. Never before such rock-bottom prices! FULLY GUARANTEED! Backed by 30 years of fair dealing. Ten day trial. Easiest terms in history—as low as 50c a week. **FREE** big price slashing catalog shows all makes in colors, details on 10-day trial and easiest terms. **FREE** Van Zandt Touch Typing course with your typewriter. See catalog before you buy. **Mail coupon now while stock is complete.**

INTERNATIONAL TYPEWRITER EXCHANGE

231 W. Monroe St., Chicago, Ill., (Dept. 401)

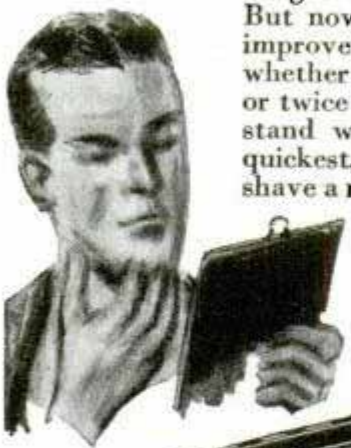
Send Free Catalog in colors showing late model standard Typewriters at tremendous savings with no money down and 10 days' trial.

Name.....Address.....

Town.....State.....

YOU'RE RIGHT— THE CONVERSATION'S ABOUT MEN

"YOU BIG PORCUPINE," I said to him. "What's the big idea not shaving off those bristles before coming to see me! Then he pulled that old gag about what two shaves a day does to a tender skin. And I said if he had any serious ideas about me, he'd better get wise to that old-fashioned skin torture he called shaving and get himself a nice, smooth Barbasol Face."



CONTRARY AS A MULE—guess that's why it took me so long to get around to Barbasol. But now that I look at the improvement in my skin—whether I use the razor once or twice a day—I can understand why they call it the quickest, easiest, smoothest shave a man ever had. (Your druggist has Barbasol in three sizes, 25¢, 50¢, 75¢. 5 Barbasol Blades, 15¢.)

For Modern Shaving

No Brush • No Lather • No Rub-in

J1220

Fog of War

(Continued from page 517)

The fog of war that the hydrophone pierced now began clamping down on the submarine; for Ralph Brown, another American, perfected the antenna detonator, which made feasible a mine barrage across the North Sea. With 70,000 mines laid across the only channels to the shipping lanes, the submarines faced an invisible menace that broke down the morale of crews, caused the German navy to mutiny.

These spectacular examples are duplicated on a smaller scale by the smallest of fighting units. A corporal's squad of eight has two men permanently designated as scouts, their job in battle being to precede

Army Air Corps photos are developed quickly in this trailer darkroom and delivered to ground troops

the advance, force the enemy to reveal their position by firing upon them. The success of the sniper, operating alone, depends entirely upon his ability to disguise himself as some part of the normal wartime landscape.

A battery of artillery dares not take up position where it can fire directly upon the enemy, for being able to see, it could be seen and destroyed. Instead, it hides behind hill or woods, while an observer in airplane, balloon, or high ground directs its fire by telephone or radio. Even then, the guns must be elaborately camouflaged against aerial observation.

Even perfect concealment is protection for only a limited time. Aerial observers can spot the flash of a hidden gun. This failing, a pair of sound-detector squads, operating in unison, can determine the gun position by triangulation.

The field telephone and portable radio are indispensable to a commander, but it is difficult to keep communications private. Wires laid parallel with the line a considerable distance away may pick up the conversation by induction, and radio messages are easily intercepted.

Sometimes a lack of knowledge on both sides will result in a surprising victory for one or the other. Typical is the case of a World War attack by the Germans on a sector held by American forces south of the Marne. Just at midnight of July 14, 1918, blasts from a thousand German guns ripped the silence of the front. A major in the 30th Infantry picked up his field telephone to warn his battalion of the attack, but the line was dead.

Rockets were sent up, calling for counter artillery fire. Runners, dispatched to direct front-line companies to hold their positions and to report how the battle was going, never returned. Then runners arrived from the front, one reporting that two platoons of his company had been wiped out. About dawn the major reached regimental headquarters and reported to his colonel that two of his companies were lost, no trace of them had been found since the attack began.

Up at the front, a lieutenant commanding one of the "wiped out" platoons diagnosed the attack as a "good sized raid"—lack of communications prevented him knowing the full extent of the attack. The lieutenant held on at his position until he could bring back 150 enemy soldiers to the colonel. Later the colonel learned, to his further surprise, that the companies reported by the major as "lost" had stopped the great offensive cold. The Germans were equally in the dark as to what was happening. One major, confident the battle was won, led his battalion in close column along a road at daybreak and it was annihilated by surprise fire from that other platoon which had been reported as "wiped out."

So, in spite of all precautions and scores of inventions to pierce the fog of war, obscurity and confusion are still normal on the battlefield. An army text warns officers that "late, exaggerated or misleading information, surprise situations, are to be expected. The normal is abnormal, and uncertainty is certain."

¶Our Bureau of Information keeps on file the names and addresses of makers of, and dealers in, all devices described in the pages of Popular Mechanics Magazine. We are glad to furnish this information to our readers upon request, accompanied by stamped, self-addressed envelope.

MEGOW'S
4 Sensational New
25c UP
(By mail, 10c extra)
WAR-TIME MODELS
Airplanes that are in the news! Build one or all of these new Megow models. It's fascinating... instructive! The four latest in Megow's famous 25c line include the HAWKER HURRICANE, the fighting terror of the British; the CURTISS PURSUIT, favorite of the French; the speed demon BELL PURSUIT and the RYAN STM Military Trainer. Each kit contains detailed plans and everything needed to make one of these 24 in. models. Full-color insignia sheets and Motor Hum Device included.
CURTISS PURSUIT
BELL PURSUIT
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GAS-POWERED
SOARING Eagles
$2.95 up
3-unit construction—fuselage, wing section and tail section—easy to build, transport and fly. Cockpit for ignition unit under wing section. Climbs at steep angle. Low-mounted wing avoids tendency towards looping.
CLASS A. Span 46 in. For class A motor. Finished propeller $2.95
CLASS B. Span 54 in. For class B motor. Finished propeller $3.95
CLASS C. Span 6 ft. For any 1/5 h.p. motor. Finished propeller and puncture-proof rubber wheels . . . $4.95
(Any gas model by mail, 20c extra for postage)
Send 5c postage today for big 100-page illustrated catalog of Model Airplanes, Ships and Railroads, model builders' equipment and supplies.
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Dept. PM Howard & Oxford Sts., Phila., Pa.
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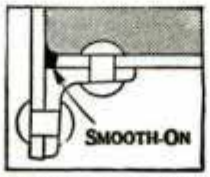
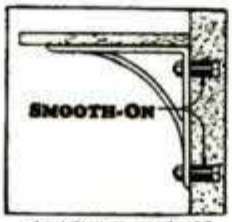
Only repairs with Smooth-On No. 1 combine these advantages:—Quick completion and readiness for service, easy application, and very low cost.

Smooth-On No. 1 offers everything that is best for repairing cracked pressure parts, stopping joint and seam leaks on water, steam and gas lines, tightening loose screw threads or parts, anchoring bolts, studs and screws in masonry, etc. A perfect hold is assured and the tightness is permanent even under extreme pressures, temperature changes and vibration.

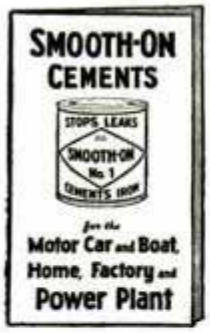


Stopping leak at a joint



Anchoring shelf in masonry

If you would become expert on household and automobile repair work, want to know what Smooth-On has done and can do, and if you would prepare to make mere trifles out of many otherwise troublesome jobs, get the free Smooth-On Handbook and follow its instructions. The working diagrams cover all sorts of applications, and make choice of correct procedure easy.



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Jersey City, N. J.
Please send Smooth-On Repair Book.

Name.....

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4-40.....

Do it with **SMOOTH-ON**

Heroes of the Deluge

(Continued from page 533)

workers. They carried 289 tons of food, twenty tons of milk, $250,000 worth of medicines, seventy-five tons of mail. They aided in law enforcement, buried the dead, towed houses back to their foundations.

These heroes slept where fatigue overtook them, in open boats, on levees, in freight cars. They carried their food and drinking water. They washed in waters dipped from the flood. Most of them suffered colds, several had pneumonia.

Their adventures were many. Boatswain William Kincaid rescued 348 persons in Paducah before he ran afoul of a submerged roof, ripping a three-foot hole in his boat. Stuffing his coat into the hole,

Coast guard lifeboat is loaded on a railway flatcar for shipment inland for flood duty

he succeeded in placing his eighteen passengers, all evacuated sick from a hospital, on board an Ohio River steamer before being swamped. Another surfboat gave the swamped craft a tow, and emergency repairs were made. Five days later the same boat hit a submerged truck and was swamped again, but not before Kincaid transferred his six rescued passengers to a roof. Repairs made again, Kincaid followed the crest of the flood downstream. When the waters receded after forty days, he had rescued 1,395 persons.

Not all the flood heroes are coast guardsmen, of course. Word reached Evansville that ten nurses were needed at Calhoun and Owensboro, Ky. Ten volunteers set out in a small boat and after six hours of bucking the current found darkness approaching with only nine miles covered. Worse yet, the current had so increased that they were going backward. So the ten undaunted women worked their way to the shore, camped all night with no

(Continued to page 126A)

I'M GLAD I BOUGHT AN IDEAL LAWNMOWER SHARPENER AND WENT INTO BUSINESS FOR MYSELF . . .

YOU, TOO, CAN HAVE A PROFITABLE BUSINESS OF YOUR OWN...

Our free plans show you how to build a successful business of your own sharpening lawnmowers. Most men earn up to $25 a week, even in spare time. Howard Hellen, Minn., writes, "I sharpened 745 lawnmowers, sold 60 used mowers and grossed $1100.00 from April 5 to Sept. 15." Roy F. Stier, Wisc., writes, "I paid for my Ideal Sharpener in exactly 36 days." Like magic, the Ideal Lawnmower Sharpener makes old, dull, badly worn mowers cut like new. Simply set the mower in the Ideal, make a few simple adjustments and the machine does the rest. Sharpens any mower to perfect edge in 15 to 20 minutes—usual charge $1.00 to $1.50. Attach to light socket. Start in your basement or garage. Work spare time or full time. Attachments for grinding skates, grass shears, hedge shears, sickles, scythes and axes. FREE CATALOG tells complete story.

THE FATE-ROOT-HEATH CO.
440 Bell Street **Plymouth, Ohio**

Make Money! SHARPEN LAWNMOWERS THE "IDEAL" WAY!

$13.95 Full Set

MICROMETERS

Six piece set, in velvet lined leather case. Special price, only $13.95. Precision machined in one thousandths, up to 4" outside and 3¾" inside measurements. Guaranteed accurate, easy to read and adjust. Satisfaction guaranteed or money back.

This is your opportunity to get one at a Bargain Price if you act now. Shipped prepaid on receipt of remittance. On C.O.D. shipments, send deposit of $2.00.

MICRO PRODUCTS, 529 E. Jefferson Ave., Detroit, Mich.

Handiest power mower ever built—only one with easy one-hand control—cuts 18" swaths; mows large lawns in quarter of time for only 5c fuel cost. Quiet, easy starting 4-cycle motor; adjustable cutting heights; rubber tires. Easy terms. Model "D" $110, Model "S" shown... **$79.50**

Write EVINRUDE 1797 W. Hope Ave. Milwaukee, Wis.

EVINRUDE LAWN-BOY POWER MOWER

DO YOU

WANT a new business profession of your own, with all the trade you can attend to? Then **become a foot correctionist,** and in a few weeks earn big income in service fees,—not medical nor chiropody—easy terms for home training, no further capital needed, no goods to buy, no agency. Established 1894. *Address*

Stephenson Laboratory, 1 Back Bay, Boston, Mass.

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PROTECT YOUR TOOLS FROM THEFT
Write with electricity any name or design on the hardest and finest tools and instruments, or any metal, like writing on paper with pen or pencil.
Complete Outfit $3.50—Prepaid Anywhere
Interesting illustrated circular free. **Write today. Agents wanted.**
ARKOGRAF PEN CO., 3927 S.E. Stark St., Portland, Ore.

Thompson BEATS the World on BOATS

Safe Boats With Full Length Spray Rails
Keep passengers perfectly dry—even at high speeds. Catalog also shows today's five most popular models of sailboats. Two big factories. Prompt shipment.

CATALOG FREE
Write for your copy. State kind of boat in which you are interested.

Better Built Lower Prices

THOMPSON BROS. BOAT MFG. CO. [94]
213 Ann St., PESHTIGO, WIS. (*Write to either place*) 113 Elm St., CORTLAND, N. Y.

TEST-O-LITE

Tests Everything Electrical From 100 to 550 Volts

A real necessity for electricians and home because it has 1001 uses. Equipped with a Neon light which tells instantly where trouble lies in electric circuits, fuses, cut-outs, motors, radios, all kinds of electric appliances, etc. Tells A. C. from D. C. Far superior to ordinary clumsy test bulb. Fountain pen size with clip for carrying in vest pocket. Lifetime guarantee.

PATENTED

APPLIANCES

MOTORS

FUSES

L. S. BRACH MFG. CORP.
55 Dickerson St., Newark, N. J.

It's time to remove the anti-freeze from your car! Also a whole winter's accumulation of rust, scale, sludge and sediment! They clog the delicate veins of the radiator. The motor overheats. You waste power. You may find yourself with an expensive repair bill on your hands.

Don't take a chance. Clean out anti-freeze with Sani-Flush for 10c (25c for the largest trucks and tractors). Just pour it in. Run the engine, drain, flush and refill *(directions on the can)*. Then your radiator is really clean. And your car runs cool. Do it yourself. Or, if you prefer, have your garage or service station do it for you. Insist on Sani-Flush. It cannot injure motor or fittings. You'll find Sani-Flush in most bathrooms for cleaning toilets. Sold by grocery, drug, hardware, and five-and-ten-cent stores. 10c and 25c sizes. The Hygienic Products Company, Canton, Ohio.

Sani-Flush
CLEANS OUT RADIATORS

Safe NOT CAUSTIC

FIRE EXTINGUISHER only $3.85 Complete
Full quart size—pump type—with fluid and bracket at a LOW PRICE! For boats, cars, trailers, shops, homes, etc. Complies with government regulations for motor boats. If your dealer can't supply send $3.85 and we pay postage. We have no agents, but sell through established firms.
JAMES KING & CO., 523 S. W. Pine St., Portland, Oregon

STOP Itching GET RELIEF This Fast Way -or Money Back

For quick relief from itching of eczema, pimples, athlete's foot, scales, scabies, rashes and other externally caused skin troubles, use world-famous, cooling, antiseptic, liquid D. D. D. Prescription. Greaseless, stainless. Soothes irritation and quickly stops the most intense itching. 35c trial bottle proves it, or money back. Ask your druggist today for **D. D. D. PRESCRIPTION.**

(Continued from page 124A)

shelter from the freezing rain. The waters arose and marooned them. Rescued next day, they insisted on proceeding to their jobs in the inundated towns.

When Lake City, Ark., was inundated, Eunice Guthrie remained alone at the town's telephone switchboard three and one-half days placing 850 important calls for Red Cross and other officials.

Keeping open communications is one of the most important, yet most difficult, of all tasks confronting disaster workers. Usually phone lines go out when the waters rise. The Red Cross, using "ham" radio operators and personnel and equipment of the coast guard, has an emergency system which assures continuous communications. Lieutenant Ford of the coast guard had charge of the system in the last big flood. Communication trucks were rushed to the flood area. They would tie in with the local telephone system and keep in contact with boats by radio. Master stations at key cities tied the isolated areas into a single radio-telephone net.

Local Red Cross chapters in practically every city and town fronting on a river have studied local hazards. They have developed a warning service that can be put in operation at once. Volunteers have been trained in first aid. Truck drivers and boatmen are being trained to evacuate those in danger. Hotel managers, real-estate dealers have pledged housing facilities. Restaurants have pledged cooks, grocers their food supplies. Physicians and nurses by the thousands have registered, and are waiting the call.

All of these are heroes of the deluge.

Wall Paint with Luminous Glow Lights Interior of Room

Room interiors will glow brightly when subjected to ultraviolet rays, according to German chemists, if walls are coated with a luminous paint which they say has been produced. Evolved from tar products, "lumogen," as the material is known, can be produced cheaply, it is claimed, and can be mixed with paint, concrete, wallpaper or floor polish, so it would be possible to finish rooms with glowing walls, ceiling and floor. Brightness of illumination can be controlled by varying the proportion of lumogen or regulating the strength of the ultraviolet light.

SpeedWay DRILL $7.95 GRINDER $5.95

QUALITY TOOLS ... products of SpeedWay, for 30 years leading manufacturers of electric tools. Specially wound high torque 110V universal tool motors. Improved designs, correct speeds. 1000 RPM **Drill** with die cast handle has ¼" capacity in steel. 20,000 RPM **Hand Grinder** has speed essential for efficiency and collets for both ¼" and 3/32" arbors. **Drill** and **Grinder** sold singly or together with 5 accessories in fitted Steel Kit. Stand takes either drill or grinder. **Router Frame** converts grinder into router. **Bench Grinder** is complete with motor. Write for Circulars. **SpeedWay Mfg. Co., 1842 S. 52nd Ave., Cicero, Ill.**

NEW Grinding Attachment

For 8" to 16" Metal Lathes. Build it Yourself.

At last, a precision grinder within your means. You save 2/3 by finishing our semi-machined castings on your own lathe. HURON handles both *internal* and *external* grinding. Accuracies to .00025". Mirror finish easily obtained. Grinds *valves, pistons, bushings, shafts,* hard or soft, *holes, lathe centers.* Sharpens *reamers, milling cutters.* Does *eccentric drilling;* laps; polishes; scores of other uses, for home workshops, garages, machine shops. Write for *FREE* illustrated folder and full information.

Semi-Machined Castings Only $5.95

Huron Machine & Tool Co., Dept. B-4, Yale, Mich.

Send FOR MY NEW BARGAINGRAM NO. 242

A monumental work—lists thousands of STILL Cameras — New and Used. . . . apparatus galore — Slide Projectors—Gigantic Book Section . . . Chemicals, etc. etc. Also Cine Catalog No. 240 — Both FREE.

Bass CAMERA CO.

179 W. MADISON ST., CHICAGO, ILL. DEPT. P

Red E Universal Tractor

You plow, disc, cultivate, mow, haul, do belt work, for about 33c a day. Safe, trouble-free long life. **New plow lift, new reverse.** Hundreds used. **Save by buying from maker.** Two weeks trial. FREE catalog. **Write today.**

PIONEER MFG. COMPANY
Dept. V-40 West Allis, Wis.

GOOD FELLOW To Ride With

The Hull Streamline Auto Compass is a worthy companion for any motorist. Provides the comfort of knowing your directions at all times . . . absorbs part of the expense by saving the cost of lost miles and time. Attractive Bakelite case, genuine sapphire bearing, built-in compensator.

Only $2.95 at your dealer. Write for Literature.

HULL MFG. CO., P. O. Box 246-D4, WARREN, OHIO

TRAILER BUILDERS · BUYERS · OWNERS

TRAILER *Send 25c for this Big Book Today*

Over 100 pages! **Beautifully Printed** and **Illustrated! Trailer Suggestions** and **Ideas galore! Catalog shows America's greatest line of Trailer Parts and Equipment at lowest prices.** Everything from wheels to top. Rush 25c today. Satisfaction positively guaranteed!

TRAILER SUPPLY CO. Box 438-A WAUSAU, WIS.

BUILD IT YOURSELF

The Jim Dandy Cabin Cruiser

The Trailer that has everything. Classy! Roomy, Easy to build in any size with my simplified Plans and Instructions—Price $1.00. Rush dollar bill today to JIM DANDY Box 125-A WAUSAU, WIS.

Write with Electricity

NEW MODEL ELECTROGRAF

Writes easily on the hardest metals or tools. Positively identifies your tools, protects against theft. Absolutely permanent. Requires few seconds only—anyone can operate. Pays for itself. A Money Maker.

Order yours today — two for $3.00 P.P. to agents

If M. O. or check accompanies order, we pay postage. AGENTS: Write today for our proposition.

$1.98 POSTPAID NATIONAL LABORATORIES, Portland, Ore.

HOT WATER with SPEED KING

From Any Electric Light Socket

MILLIONS of homes, stores and offices everywhere need **SPEED KING**—the new, amazing **Water Heater**—that heats water boiling hot so fast it takes your breath away. No muss! No waste of time or fuel! Just a simple "plug-in" at any 110-volt light socket—and presto . . . just the amount of hot water you need for the bath, for shaving, for dishwashing. **CHEAPER** because you don't have to heat gallons when you need only a few quarts. **FASTER** because the intense electric heat goes directly into the water. Sells fast on a 60-second demonstration. Small in size—fits the pocket, easy to carry. Anyone can afford it.

60-SECOND Demonstration Amazes Housewives

SAMPLES for AGENTS

I WANT you to know the almost uncanny heating action of this speedy water-heating invention. Write quick—a postcard will do—for my **SAMPLE OFFER** that brings you an actual Sample **SPEED KING** for demonstration. You can make plenty of cash as my agent. HURRY! Big season starting now. **SPEED KING** solves the hot water problem when furnaces shut down. Act quick and I'll show you how to make the fastest money of your life. Send No Money!—*Just your name.*

NU-WAY MFG. COMPANY
Dept. 164, Walnut Bldg., DES MOINES, IOWA

JUST SEND NAME

WRITE your name and address in the margin, clip & mail this coupon or send penny postcard to Dept. 164.

Name .....
Address .....
City .....

You Can Make BIG MONEY Surfacing Floors the American Way

Get into something where your income is only limited by your ability to get ahead. The American electric method of floor surfacing gives you the opportunity to make more money for yourself—work easy to get and no previous experience required. If you are not afraid to put on a pair of overalls and go to work, here is the chance of a lifetime.

Let us tell you how to be a success in this business and tell you how many other men who started like you have made themselves independent for life. As little as $75.00 will start you today on the road to success.

Be sure to sign and send in the coupon below or mail us a post card for complete free details—no obligation.

THE AMERICAN FLOOR SURFACING MACHINE CO.
523 So. St. Clair Street • Toledo, Ohio

Gentlemen:
Send complete free details on how I can make big money with an American floor surfacing machine—no obligation.

Name .....
Street .....
City ..... State .....

The World's Biggest Chess Game

(Continued from Coloroto Section)

Navy has fifteen battleships organized in four divisions, each of which is commanded by a rear admiral. A vice-admiral commands the entire group, with the title Commander Battleships, Battle Force.

The aircraft carrier is for all practical purposes a floating airport or airdrome. Planes take off and fly aboard their broad expanse of decks. Machine shops are found aboard for overhaul and repair work. Spare parts and engines are carried. Carriers must be fast, long-range ships, and depend primarily on other units of the fleet for defense against attack. Their own planes are probably their best defense against air attack.

A vice-admiral with the title Commander Aircraft, Battle Force, commands the five carriers assigned to the group.

Heavy cruisers came into being as a result of the naval conference after the World War. These vessels of 10,000 tons displacement have long cruising radii, capable of high speed and are equipped with eight-inch guns. Armor has been sacrificed for speed, hence the type depends upon speed and maneuverability to escape from superior enemy forces that may be encountered. This type is effective against enemy cruisers, destroyers, and small craft. They are particularly valuable in locating enemy forces at sea, in raiding and destroying enemy commerce, and in protecting our own merchant ships. We have now eighteen heavy cruisers that are organized in divisions, each commanded by a rear admiral.

The light cruiser falls in the category of cruisers of less than 10,000 tons, and mounts six-inch guns. These vessels, like the "heavies," have long cruising radii and high speed. They are the largest type that carries torpedoes, hence their offensive duties are somewhat different from either the battleship or the heavy cruiser. They are in a position to attack both battleships and heavy cruisers with torpedoes while with their guns they are capable of breaking up enemy light force attacks. This class is well suited for commerce destruction and, like the heavy cruisers, are useful for protection of our own commerce. There are nineteen light cruisers in our fleet.

The destroyer, equipped with guns, torpedoes, depth charges, and guns of five-inch or less may, if opportunity presents itself, attack, harry and destroy every type of ship known. Although the smallest of surface craft, the destroyer has more offensive strength per ton than any other type. These hornets of the sea are of superlative speed and are of all types the highest powered per ton displacement. When operating against vessels of larger size the torpedo is the primary weapon of the destroyer.

The United States now has 149 destroyers in commission, of which eight are light mine layers, and eighty-one out of commission. Of the destroyers operating with the fleet today some are of 1,850 tons, some 1,500 and 1,200 tons. The smallest unit for operating destroyers is the division of four ships; three divisions comprise a squadron, and eight squadrons a flotilla.

We come next to the submarine, weapon of opportunity, of which much is heard in these days of war. Submarines are designed to travel beneath the surface, and are armed with guns, torpedoes and mines. In the event of hostilities submarines may be used for scouting; that is, locating enemy vessels, observing enemy ports and coasts, and operating against enemy commerce. In any strictly defensive employment, submarines would lay mines and patrol our coasts. If the opportunity came or could be created, submarines would, in a fleet action, attack enemy capital ships. The best defense against the submarine is to keep it down. This is best accomplished by fast destroyers or patrol vessels making depth-charge attacks. The only good submarine is a dead one, or one without torpedoes. The submarine makes a surprisingly small target and is extremely difficult to hit even at medium ranges, and is the lone wolf of the sea in offensive operations against commerce.

The United States Navy has sixty submarines in commission under the Commander-in-Chief, United States Fleet, but organized as a separate force commanded by a rear admiral. There are thirty-six other submarines in reserve.

In addition to the combatant types, a navy must have cargo ships, store ships, oilers, ammunition ships, seaplane tenders, destroyer tenders and submarine tenders.

The mine force with the foregoing types

(Continued to page 130A)

You may worry about your wife's hat

but here is one worry you can avoid

If it isn't one thing to worry a man it's another—bills, bosses, the wife's hat—they're all the same—worry, worry, worry.

That's why it's such a wonderful feeling to find perfect Peace Of Mind about something, once in a while.

If you let us Marfak your car every 1,000 miles, you'll have Peace Of Mind every mile you drive.

For Marfak is Texaco's famous, standardized 40-Point Lubrication Service—every point checked and properly cared for.

And at every vital friction point, we use Marfak—an extra tough lubricant—from which the service takes its name.

Marfak is so tough, in fact, it lasts twice as long as ordinary grease. Why not drive in and let us Marfak your car?

TEXACO DEALERS INVITE YOU TO tune in the TEXACO STAR THEATRE—A full hour of all-star entertainment—Every Wednesday night—Columbia Network—9:00 E.S.T., 8:00 C.S.T., 7:00 M.S.T., 6:00 P.S.T.

Let us **MARFAK** *your car*

TEXACO

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The Texas Company

TEXACO'S 40-POINT LUBRICATION SERVICE AT ALL TEXACO AND OTHER GOOD DEALERS

Moisture-resistant joints repair chair permanently

HINTS FOR GLUING CHAIR RUNGS, DOWELS, DRAWER PULLS, ETC.

1. Clean old glue off. Apply thin Casco mix. Let dry. Apply *heavy* Casco mix, let stand 5 minutes until tacky—clamp.

2. For badly fitting joints—soak strip of thin cloth in *standard* Casco mix, wrap around rung until fit is tight.

3. When clamps are impractical, use heavy rubber bands (as illustrated) to hold rungs together while glue sets.

For details, see CASCO GLUING GUIDE offered in coupon.

No sissy glue can do that repair job and do it *right* ...because even *indoor* weather changes can wreck a glued joint. That's why you need CASCO's chemically-setting bond that defies heat and moisture changes. Do as leading furniture manufacturers do—use CASCO and make joints that *hold.*

CASCO is easy to use. Just add water and mix to the right consistency for the job. No heating. No mess. 10¢ to 65¢ at hardware, paint and lumber dealers.

NEW ODD-JOB CEMENT

FOR SMALL WORK *in home, school and office, use new* CASCO FLEXIBLE CEMENT. *Sticks wood, felt, fabric... to metal, plastics, glass, etc. Doesn't "gum" on fingers. Large tube, 25¢ at hardware stores.*

FREE Handy Workshop Folders

CASEIN COMPANY OF AMERICA, Dept. PM-440
350 Madison Avenue, New York, N.Y.

Please send me free folders checked below:

- ☐ **HOME WORKSHOP HANDBOOK.** Tells where to get free and low-cost booklets on every workshop subject.
- ☐ **CASCO GLUING GUIDE.** 36 pages. 70 successful uses for CASCO GLUE. Complete directions and suggestions.
- ☐ **PROJECT FOLDER.** Pictures of 24 popular projects. Tells how CASCO-users can get complete plans free.
- ☐ **CASCO FLEXIBLE CEMENT FOLDER.** Directions, suggestions for home, school and office.

*Name*_____

*Address*_____

——— Save 2c. Stick coupon on penny postcard ———

Say you saw it in Popular Mechanics!

(Continued from page 128A)

constitute the on-the-surface and under-the-sea navy, but one of the most important arms, that of the air, must be considered.

Naval aviation has been designed and trained to accompany the fleet wherever it is required to go, and operate in the closest co-operation with the fleet. Naval aviation operates not only as an arm of the fleet, but assists local defense forces in the patrol of coastal zone, sea lanes, and protects shipping therein. The more airplanes that can be spared to scout against an enemy at sea, the more surface vessels that can be maintained in a fleet concentration. Foreign experts say that the naval aviation of the United States is the best trained, most efficient sea air force in the world.

The United States Navy now has about 2,000 airplanes, and is authorized a strength of not less than 3,000. All aircraft in the fleet would fall under the fighting, bombing, torpedo, observation, scouting and patrol types. The subject of lighter-than-air type is now under study.

The Largest Thing Ever Built

(Continued from page 549)

will be absorbed within fifteen years. Sale of the power is expected to liquidate the cost of the dam and power plant in fifty years, after which power sales will bring an estimated return of $15,000,000 per year.

River water not used to spin the turbines will pour over a 1,650-foot long spillway at the top of the dam, creating a waterfall twice as high as Niagara.

A unique problem has been what to do with the hordes of salmon that normally migrate to the headwaters of the river to spawn. The fish make their way past the Bonneville and Rock Island dams downstream by means of fish ladders and escalators, but Grand Coulee is too gigantic a mass for them to climb. No fish can get by the big dam. The salmon spawn in tributaries of western Washington rivers, beginning with those nearest the sea and continuing far inland. The first opportunity to count the run is at Bonneville dam, 146 miles from the sea, after enormous numbers have been caught, and after those native to the lower tributaries have left the river. According to Bureau of Fisheries estimates, about four per cent of the Chinook (king) and thirteen per cent of

the blueback (sockeye) fish that pass the Bonneville dam formerly went above the Coulee dam site, which is 600 miles from the sea. The propagating of fish as a substitute for natural spawning above the Coulee will increase the salmon run.

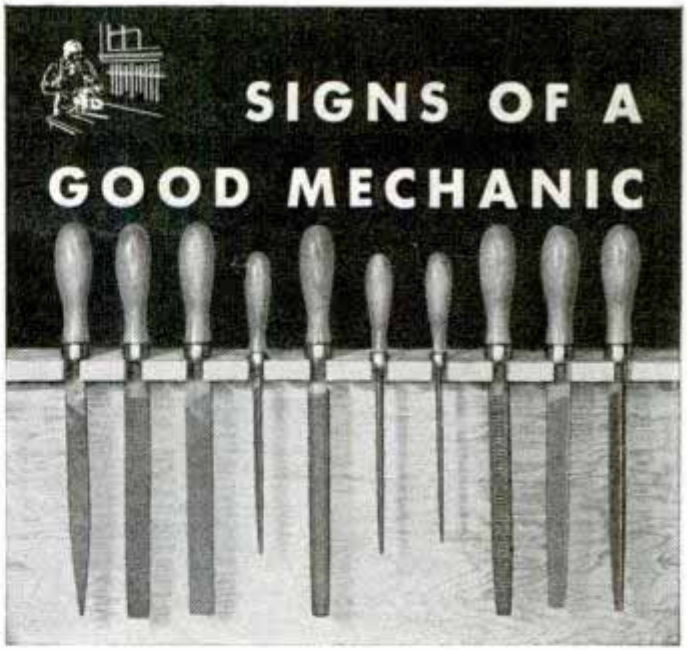
Last year fish were trapped at a lower dam and were transported in aerated and cooled tank trucks to tributary rivers below Grand Coulee where they were confined to their new spawning territories by weirs placed in the streams. The 1940 run is being transported to a great fish hatchery and the new crop of fingerlings is to be planted in rivers below the dam, after which it is expected that the fish will return to spawn in the streams in which they were planted.

Grand Coulee was begun in 1934 and will be completed in 1942. Everything about the great mass of concrete is fabulous. Eighty-three tons of welding rod are being used in making the nine miles of welds required to complete the steel penstocks that will lead the water to the turbines. Eleven miles of X-ray film will be exposed in the job of studying these welds. Rodmen making a topographic map of the irrigable area will walk 70,000 miles.

Sand and gravel are secured from a deposit more than a mile away and 20,000 gallons of water per minute are used to wash the materials clean. Two thousand to twenty-seven hundred tons of these aggregates are transported to the dam every waking hour over a system of conveyor belts. The largest of these, an endless band of cotton and rubber two miles long, weighs eighty tons. Sixty to 100 boxcars of bulk cement arrive at the dam every day. From the storage silos this cement is blown at a speed of 100 miles per hour through a fourteen-inch pipe to the mixing plants a mile and a quarter away. The two mixing plants each contain four four-yard mixers. These are controlled by push buttons at a central office.

Grand Coulee is being finished by Consolidated Builders, Inc., under the direction of the Bureau of Reclamation of the United States Department of the Interior, with funds provided by congress.

If you will send stamped, self-addressed envelope to our Bureau of Information, you will be given the name and address of the manufacturer of or dealer in any article described in this magazine.



ARE you a "hobbyist," model maker, or master of a metal-working trade? Then you're one who recognizes the absolute need of good tools to do good work. There's little difference between the cost of hit-or-miss-quality files and Nicholson (or Black Diamond) Files. But there's a world of difference in results—and satisfaction!

Push a Nicholson double-cut flat file across a piece of metal that needs a lot of stock removal, and see it bite in like a hungry pup's fangs whittling down a bone. See, too, how it holds to the line like a keen-edged skate-runner! All due to exclusive (patented) serrated tooth construction*—and to Nicholson's tough hardness and other superfine qualities! Or, lay a Nicholson single-cut mill file onto a piece of precision work and note its sweet-cutting performance!

A popular work-bench assortment of Nicholson or Black Diamond Files will prove a prized possession. Your hardware dealer can supply you.

*Special-type serrations (left) give Nicholson and Black Diamond File teeth successive new cutting edges—assuring longer cutting efficiency. Ordinary file teeth shown at right.

FREE
28-page Book on Filing
Write for your copy. Tells how to select, use, take care of files. Use the coupon.

NICHOLSON FILE CO.
22 Acorn St., Providence, R. I., U. S. A.
Send free book, "A File for Every Purpose."
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See them all—1940 **RADIO HITS!** New "Camera" Portables—new European reception models—new "Compacts"—all types, all sizes, for every purse and purpose. Also new phonographs, auto radios, "Ham" receivers—all in this new FREE Catalog.

18 new Public Address Systems—6 to 70 watts—for Electioneering, Orchestras, Churches, Schools, rentals, etc. America's finest at startling low prices. Easy Time Payment Plan. Complete accessory listing, new recording equipment, etc. See them all!

Dozens of brand-new exciting kits—new diagrams—new gadgets. Easy to build; low-cost. Build your own—learn radio—it's a great hobby! **Send for ALLIED's new revised Radio Builders Handbook.**

ALLIED RADIO SEND FOR FREE CATALOG

833 W. Jackson Blvd.
Dept. 5-D-O, Chicago, Illinois

☐ **RUSH** me your **FREE** New Spring Radio Catalog.
☐ Enclosed is 10c. Send your new Builders Handbook.

NAME.....

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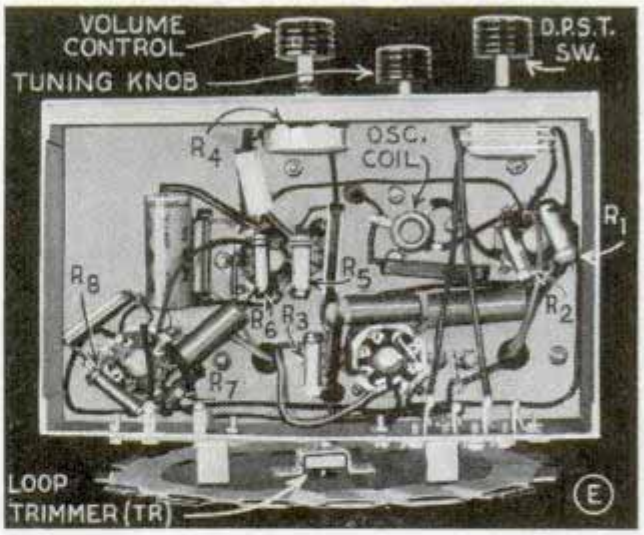
CITY.....STATE.....

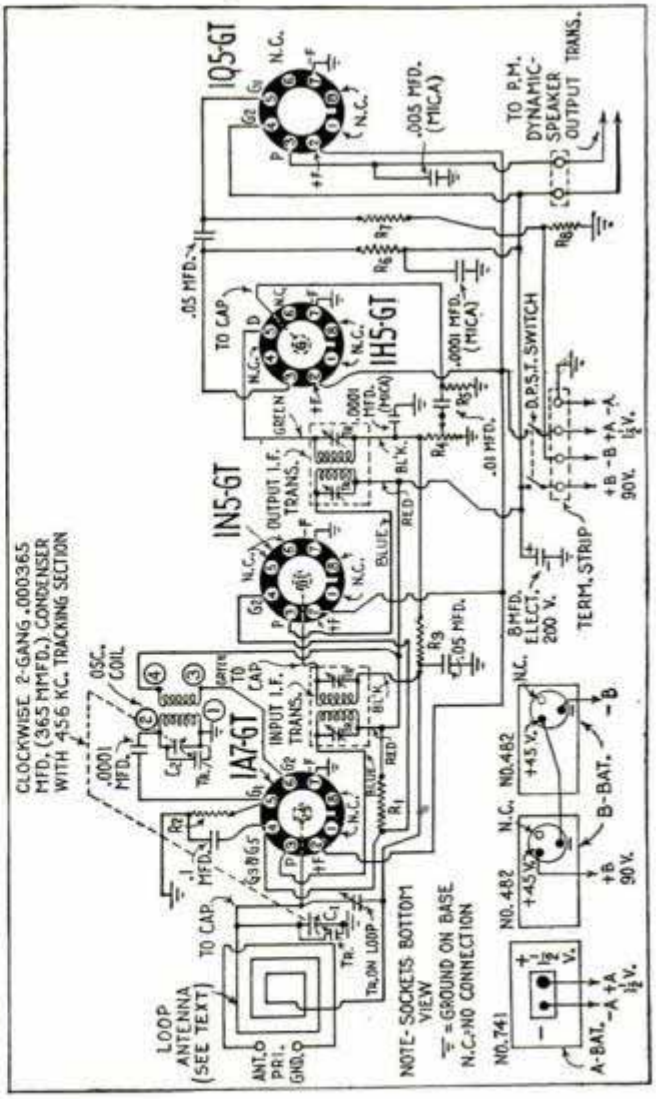
Always write your name and full address clearly when answering advertisements.

Loop-Operated Battery Portable

(Continued from page 617)



on C_2 is then adjusted until this station is received at approximately the correct frequency. The 3-30 mmfd. trimmer condenser on the directional loop is then adjusted to give maximum volume. A detailed parts list is available from Popular Mechanics radio department without charge. It should not be necessary to realign the I.F. transformers unless they have been handled roughly. Blueprint number is R-277.



Laugh at Scuffs and Scrapes

WEAR HORSEHIDE HANDS

Driver's Slip-On Style 8565 Pony White

TAILORED FOR COMFORT... TANNED FOR TOUGHNESS

NOT only tanned for toughness but tanned for comfort too. An amazing secret process makes and keeps *Horsehide Hands* soft as kid. They even dry soft after soaking, yet they can take more scraping — scuffing and hard knocks than any other glove you ever wore and still come back for more. Made by the makers of famous Wolverine Shell Horsehide Work Shoes. If your dealer can't supply you, send his name and 75c. We'll mail you a pair postpaid. Sizes 8 to 12—Style 8565. **Wolverine Shoe & Tanning Corp., Dept. D-310, Rockford, Michigan.**

WOLVERINE
HORSEHIDE WORK GLOVES

DEALERS: Carry Wolverine Full Grain Horsehide Hands and sell more work gloves. Write for catalog and tested plan.

NEW KIND OF MAN'S SHOE

The new sensation in men's shoes—the Chippewa Clipper. It ZIPS on and off in a "jiffy". Now is the right time to get into a dignified and highly profitable shoe business of your own with this fast seller, and a complete line of almost 250 styles of dress, work and sports shoes. Prices as low as $1.98 a pair. Free 10-second demonstrator sells super-comfort air-cushion shoes like magic.

Sales division of manufacturer established 36 years wants salesmen. No experience needed. Write for complete sales kit. It's FREE!

CONSOLIDATED SHOE SYSTEM
Dept. B-4 Chippewa Falls, Wisconsin

Sell SLYDE-ON TIES for Spring PROFITS!

These ready-tied ties are popular sellers wherever shown. This spring they'll sell better than ever, assuring a steady income of profits. NOW READY—a complete line of 4-in-hand ties, starting as low as $1.50 a doz. Also genuine leather ties, tie and handkerchief ensembles, etc.

EMPIRE CRAVATS
22 W. 21st St., N. Y. C. Dept. 31

YOU HAVE BEEN WAITING TO PAINT this easy way!

Now Everyone Can Paint This Easy Way—with a Spray Gun! A complete paint-spraying unit, light and compact, (weighs only 8 lbs.) designed for home use for lacquer, enamel, varnish, insecticides, moth-proofing; for screens, radiators or furniture. Strictly quality equipment—material and workmanship guaranteed. Complete unit includes high grade 110 V. A. C., D. C. motor, 6 ft. cord and plug, piston type compressor with cast iron cylinder on sturdy base, efficient spray gun with ½ pt. glass container and 10 ft. air hose. Write for Circulars, or *Send $1.00 today—pay postman balance, or shipped postpaid if full price accompanies order—dealers write.*

Miller Simons Inc., 2903 S. 61st Ct., Cicero, Ill.

HANDEE Tool of 1001 Uses!

A whole tool shop in your hand—finest, fastest, most powerful tool for its weight, 12 oz. Full of thrills for everyone. Uses 300 accessories to grind, drill, polish, cut, carve, rout, saw, sand, sharpen, engrave, etc. 25,000 r.p.m. Plugs in any socket.

Saves Hours of Hand Work

HANDEE HOBBIES
Scale drawing plans of 50 fascinating new projects. Send 25c for Portfolio of 12.

Make gifts, prizes, things for the home or to sell—ship, train, plane or house models, costume jewelry, figurines, those new engraved glass book ends, mirrors, trays, etc., from any metal, alloy, plastic, glass or wood.

ORDER ON 10 DAYS' MONEY-BACK TRIAL

DeLuxe Model Handee (illustrated) with 6 Accessories, $18.50. Standard Model, 18,000 r. p. m. with 3 Accessories, $10.75.

FREE—64-PAGE CATALOG

Complete information on Handee Products and their wide application in crafts work and industry all over the world.

CHICAGO WHEEL & MFG. CO.
108 S. Aberdeen St., Chicago, Ill.

SO MANY **BIG PAY JOBS** BEGIN WITH THIS FREE BOOK

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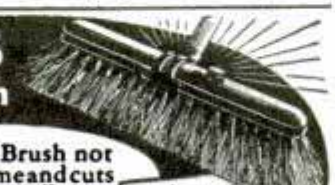

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Telescoping Antenna Mast

(Continued from page 618)

tion. A second 5-in. slide-opening frame of the same material is installed just 4½ ft. below the upper slide opening and is fastened to horizontal members that are bolted to the outside of the uprights. The bottom slide opening should be plumbed to line up directly below the top slide opening. Before pouring the cement in the holes about the base of the legs, plumb up the entire structure so that it stands vertical.

Sections Nos. 2 and 3 are 20-ft. long hollow boxes, detailed in Fig. 1. Section No. 2 is made of 4 by ¾-in. pine; this gives the section an outside width of 4¾ in. and an inside width of 3¼ in. Section No. 3 is designed to slide down inside section No. 2. Make this exactly like section No. 2, but of 2 by ¾-in. pine. It will have an outside width of 2¾ in., allowing ½ in. clearance for telescoping into section No. 2. In making the boxing, if joints should occur in the length, stagger them so that no two will come opposite each other. Give the material a thorough smoothing on both sides with a plane, and paint the inside of the stock before assembling.

A ½-in. hole is drilled through section No. 3 from side to side, 6 in. from the bottom, for the raising halyard. Section No. 2 is left open at top and bottom, but has a similar halyard hole near the bottom. When completed, give all three sections two coats of good paint. Raising details are clearly shown in Figs. 2 and 3. Galvanized ¼-in. wire-rope halyard is employed to raise sections 2 and 3; this is run over the large-deck halyard block bolted to the top of section No. 1 and down between section 2 and the slides and through the holes in the section base, where it is knotted or pinned securely. The mast is guyed four ways, at about center and top, through the four eyes in the withes, as indicated in Fig. 3. Section No. 3 is raised in the same manner as section No. 2, the deck halyard block being fastened to a length of strap iron and bolted to the side of the top of section No. 2. This second wire-rope halyard runs down through section No. 2 and fastens in the holes in the bottom of section No. 3. Attach a suitable pulley block to one of the eyes at the top of section 3 for the antenna halyard. The guy-wire anchor rods are embedded in cement 15 ft. away from the corner uprights of the tower.

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Send Free Plan on Saw Filing business.
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In the Air with the Riggers

(Continued from page 559)

apulting of the riggers into space. The "graveyard shift" always has these dangers. So many bright lights blaze from the dam and so many engineers, turning flashlights on the arches for measurements, are mistaken for riggers that the skinner is often puzzled.

This night shift during the cool western nights is anything but a pleasant experience. At 400 feet, the riggers' fingers, in spite of gloves, become numb and when the rainy season arrives, the job is almost unbearable. Oftentimes a transformer will burn out, and the rigger must remain dangling in the air, sometimes for hours.

Even though the cable is daily inspected and greased, accidents sometimes occur. Conway Gould, an old-time rigger, tells of the hunches that riggers play in suspecting a break in the mechanism. "Two young laborers wanted to ride across on the high line with me. I felt a hunch and refused to take them. About 100 feet in the air, the platform, filled with sacks of cement upon which I was standing, suddenly gave way. Instinctively, I leaped for the side of the platform and hung on for dear life. The skinner, noticing my predicament, lowered me immediately."

In order to guide the high-line skinner in his moving of the hoist, a standard code of signals for riggers has been devised. During the day, large wooden paddles are used for signaling. One hand held straight up means to start, a horizontal wave of the hand signifies to stop, and a movement of the paddle toward the rigger's head calls for a movement toward the head tower, while when the paddle is held down, the hoist moves toward the tail tower. At night, a red light flashed up and down calls for a start, while horizontal means stop. Three circular movements counter-clockwise lower the hoist, while four circular movements start the hoist toward the head tower, and a light at the side moves it toward the tail tower. At huge dams such as Grand Coulee, where hammerhead cranes are used to move the riggers, a series of buzzer signals to a distant operator set the cranes in the positions desired. Here steel riggers dangle at shaky angles, maneuvering into place steel beams for the construction of trestles high above the raging waters of the Columbia river.

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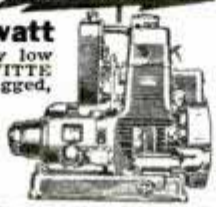

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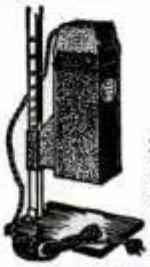

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Cameraman at the Front

(Continued from page 557)

that, No Man's Land. Gunners crouched quietly in shallow trenches. Five hundred yards back of them children were playing.

We debarked from the cars and started across the quiet battlefield on foot. Seeing a Polish-American woman struggling with her crying baby, trying to readjust her hold on a bulky suitcase, I put down my bag and went to her aid. When I returned, it was gone—with it my precious films!

At last we could distinguish German soldiers in the distance. Reaching their lines, we were loaded into trucks and three hours later had covered the twenty-five miles to Nasielsk, where a train awaited us.

Next morning at nine o'clock we arrived at Konigsberg, and for many of us fears became critical. Those whose papers were not in order, were afraid they might be headed for concentration camps. As for me, I had been quoted in the Warsaw press, had talked over the radio, and my earlier documentary films of Nazi Germany were known in Berlin. I was not at all happy. I had even lost my films.

Then, the following morning, against a wall in the lobby of a hotel, there was my suitcase. I don't know yet how it got there. Unostentatiously as possible I picked it up. Not one film was missing!

Three small rolls I particularly wished to save I slipped into my pocket. I mentioned my problem to an American girl, and she solved it for me. From another American who had been very unobliging to her, she borrowed a souvenir gas mask, hid the three films in its chemical chamber, and handed it back to the man. If it were searched, he would have some explaining to do. It wasn't; later the girl again borrowed the mask, retrieved the films and a month later gave them to me in New York. The man never knew how helpful he was.

One thing I knew I should not do—that was to travel to Berlin with the rest of these Warsaw "refugees." For there I would surely be discovered. Learning that a group of Swedes were leaving by train for Riga, I contrived to disappear from my American friends—who thought I had been taken into custody—joined the Swedes and in a few hours was across the border in Lithuania, my bag of films intact.

All the rest of my life, when I emerge from a trying situation, I'll say to myself: "Now you've crossed into Lithuania."

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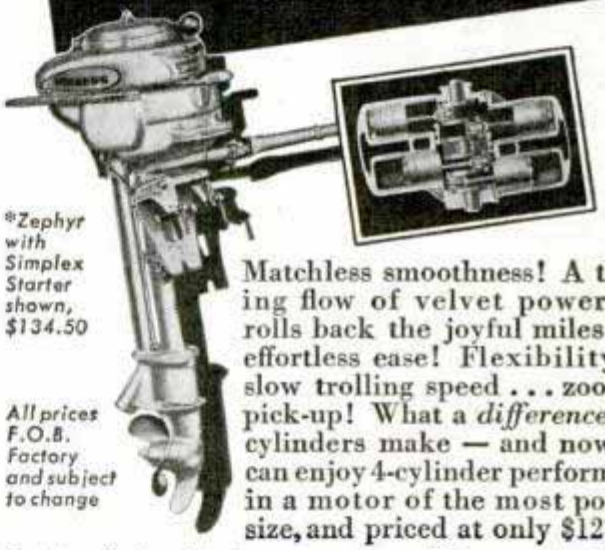

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Say you saw it in Popular Mechanics!

9-11-63

Mechanizing the Small Farm

(Continued from page 539)

century. The demand for wheat and the shortage of harvest hands during the World War were boons to the internal combustion combine and its widespread acceptance in the wheat fields of Kansas. The earlier models, fantastically large, soon were supplemented with machines having smaller cutting bars. Even these bear only faint resemblance to the new baby combine with its forty-inch cutter. Operating from the power take-off of a one-plow tractor, the combine, which fits in the family garage, is patterned after its five-foot predecessor in that it saves weedy tangled crops,

Loading grass silage immediately after cutting; sturdy loader is needed when crop is green

and harvests grains, clovers, peas, sorghums, or any one of a hundred commercial harvests.

The farmer's wife doesn't have to feed an army as the harvest crew consists of one man, or two, if the grain is to be bagged. Once over and the grain is in the bin unless the farmer wishes to mow the crop for a period of curing; then the harvester picks it up from swath or windrow. One hundred acres to be harvested yearly with about forty acres ripening at one time is the capacity of the new machine. It will cover about an acre an hour. Combine sales last year for the first time exceeded the number of binders sold.

Corn growers are watching with interest a bizarre looking machine being tested at the experimental farm of Iowa State college, a rotary cultivator fashioned to cultivate corn in two directions while traveling over the field only once, thus doing away with cross cultivation.

The campaign F. W. Duffee of the University of Wisconsin has waged to take the pitchfork out of hay-making is now bearing fruit. Although 70,000,000 tons of hay were grown in 1939 making it a major crop

exceeded only by corn, until recent years little thought was given to its mechanization. The side-delivery rake is perhaps the only change introduced in hay-making. It makes a loose, fluffy windrow that permits freer circulation of air than when hay is packed and laid flat. The rake teeth lift up the heads and leaves first, turning them toward the center of the windrow. With the stems exposed, the leafy part of the hay containing most of the protein can cure evenly and retain a bright green color, which indicates presence of vitamins.

Devices for baling hay in the field were the first step forward. Fewer handlings meant fewer leaves lost, brighter color, greater palatability. But field hay balers were beyond reach of the one-family farm.

Because ninety per cent of the hay grown is consumed where it's produced, hay-making methods probably would have remained unchanged had not grass silage come in, a development that may revolutionize dairy farms, and others to a lesser degree. Hay loses much of its food value and flavor when dried. Under best conditions, tests show at least twenty per cent of the original feeding value is dissipated during field curing, gathering, storage, and feeding. When weather is inclement, losses may run fifty per cent.

Farm scientists felt this shortage in nutrients could be stemmed considerably if a way could be found of preserving green grasses in silos, with corn and sorghum. Bacteria were the stumbling block. This caused grass silage to spoil and rot but did not affect corn silage. Green stalks in an almost air-tight silo would ferment, producing acids that preserved the green fodder as vinegar preserves pickles. Because corn contains much sugar it could produce its own acids but legumes, grasses, and green cereals had to be mixed with blackstrap molasses to promote proper fermentation.

Grass silage is now a part of the rations of dairy and beef cattle, swine, sheep, horses, even chickens. The crops suitable include alfalfa, soybeans, clovers, and other legumes; grasses, oats, rye, barley, and wheat.

The green crop is loaded immediately on the rack wagon by a specially sturdy loader. Green grass is four times as heavy as dehydrated hay. The green material is then put through a hay chopper with a

(Continued to page 143A)

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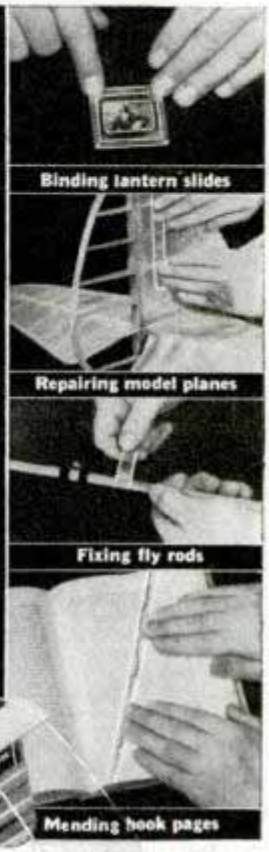

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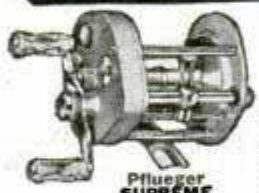

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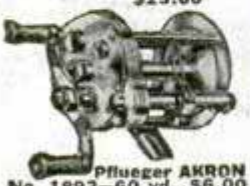

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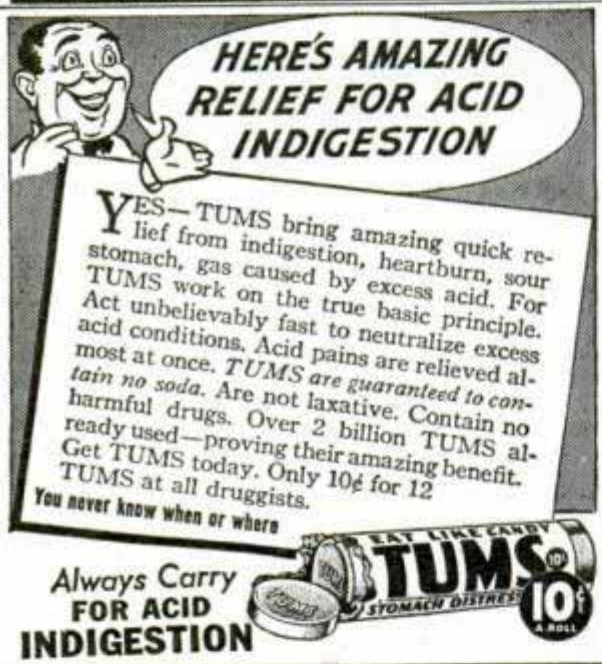
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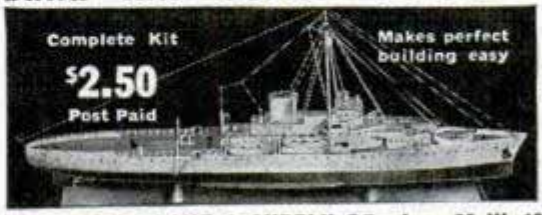

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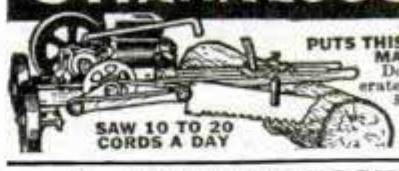

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(Continued from page 141A)

molasses distribution system. Supplying the correct amount of molasses, chopping, and elevating into the silo is done automatically. Grass silage requires less storage space, eliminates fire hazards, is easier to handle, and minimizes waste. Besides, most molasses silage crops are soil-conserving crops.

To lessen the hard labor involved in making grass silage Duffee has worked with farm machine engineers on hay field choppers. Present choppers are too large and expensive for the average farmer, but Duffee predicts the near future will bring a hay harvester to fit the farmer's pocketbook as well as his tractor. With its development, the mechanization of the small farm will be virtually complete.

Lightning on Skates

(Continued from page 569)

shoulder. It toughens those parts, and strengthens backs and legs.

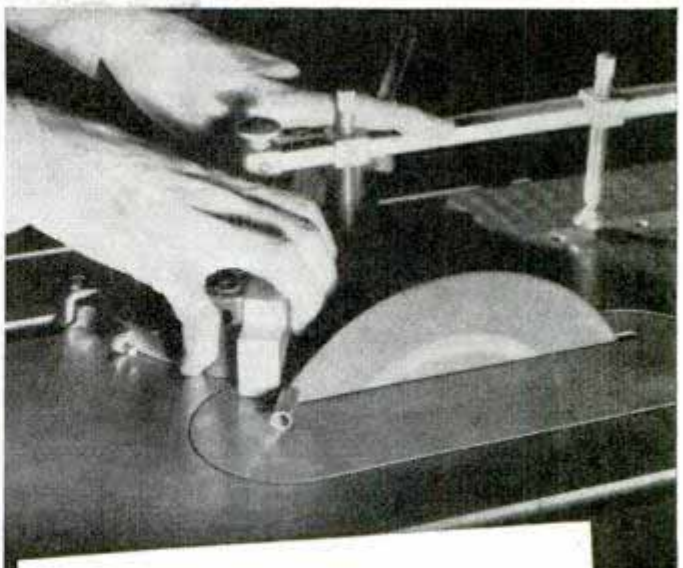
To the three forwards on the six-man team—the center, and right and left wings—falls eighty per cent of the work in an attack. Each must cover an opponent. The center covers the opposing center, the right wing covers the opposing left wing, and the left wing the opposing right wing. Thus it is seen that the wings try to operate in their respective "alleys" along the sides of the eighty-five by 200-foot rink, for strategic reasons.

Covering is a matter of impeding the other fellow as much as possible, and still stay within the rules. It is a defensive maneuver. Your opponent may have the puck, hence you get in front of him, or to his side, so as to deflect his pass or shot. You may be able to crowd him into the boards before the play reaches the attacking zone, or, if he does reach there, you may have forced him ahead and to the side far enough that he must pass or shoot hurriedly or from an awkward angle, thereby lessening his chances of success in either endeavor.

A player is a stick-handler—or he isn't a player. He must be able to make his stick do the legitimate things, and he must be able to make it do a lot of things that aren't what they seem. In its finer, more artistic nuances it is the essence of faking, plus a generous ingredient of stalling. He may

(Continued to page 144A)

SHORT CUTS FOR THE HOME CRAFTSMAN



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(Continued from page 143A)

indicate he is going to pass when he isn't, but his stick-handling scares his opponents into redistributing themselves to meet the attack. If the puck carrier's aims are realized, that gives him an opening for a shot, or for a pass to a mate. Stick-handling indicates the puck carrier's intentions to his mates, too, and they zip accordingly to positions where they may make the most of whatever the carrier may do.

Poke checking and sweep checking are other angles of using that versatile stick. The former is a matter of poking at the puck carrier's stick to make him lose the puck. Sweep checking, a one-handed

Exceptional skating skill, illustrated by this half circle, is essential in hockey

sweep with the stick, has the same purpose, with the added hope that you will thereby gain the puck for yourself.

One of the essential factors of a good hockey player is that of co-ordination between head, hands and feet. The action of the game is so split-second fast that often there isn't time actually to think what is the best thing to do. You have to train head, hands and feet to act instinctively, to do the right thing quicker than the eye can follow the play. There is just one way to achieve that perfection—practice, and more practice—two, three, four hours a day of steady drilling on skates, stick in hand, chasing the puck, playing for goals, upsetting the other fellow's efforts to make goals at your expense. There is no substitute for practice.

The art of passing is one that should be studied carefully, whether on the sending or receiving end of the pass. In maneuvering for a goal a pair of men may pass the puck back and forth several times to each other. If you are one of them, you have to be able to get the puck on your stick, hold it safe from the attack of opponents, pass it to your mate with sure aim, and all the time keep up the drive toward the goal. Here again practice must be incessant. Wing men must be alert at all times for passes coming to them from all angles, and ability to pick up a puck while on the go is of tremendous importance.

In the final analysis, passing is mainly a matter of timing and judgment. An intelligent forward will mix his plays. Sometimes he will pass to the line mate who is skating fastest, and he will drive the puck hard, so that if his wing misses it, the opposition will have a difficult time capitalizing on it, because of its speed.

Controlling the puck while skating at full speed marks the really good hockey player, and is proof of clever stick-handling. The player may have his stick ahead of the puck for a fraction of a second, then behind it, then ahead of it again, back and forth, guiding the puck, retarding it with his own speed if necessary, sweeping it from side to side out of opponents' reach, and utilizing his utmost ingenuity to set things up for a shot at the net.

On a hockey team the goalie keeps his post in front of the net, but otherwise he gets plenty of action, and his position is a hazardous one. The puck flies at him from all angles, at terrific speeds, and from all directions. It is his job to keep it out of the net. He must be highly courageous, and he must be agile and acrobatic. He may have to fall on his knees, spread his legs, fling out an arm, dodge a flashing stick at close quarters, and he must outguess the offense at all times possible. By studying angles he learns where the puck is apt to land, so that he may be there to stop it, make the save, and clear the puck by kicking, throwing, batting or otherwise driving it away from the net.

When you have learned to skate well, which involves speed, control and sureness; when you have learned the rules of offense and defense; when you have mastered stick-handling; when you can send and receive lightning passes accurately—then you're really a hockey player. It takes endless hours of practice to get to the top, and more of the same to stay there.

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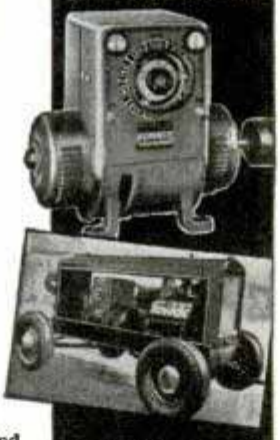

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Interested in ☐ 30 DAYS TRIAL. ☐ EASY TERMS
If you have only single phase current ☐ check here for A.C. Welder information

FREE

Handling Money by the Ton

(Continued from page 491)

selves for inspection. Dumping off the excess from a $1,000 bag of "cartwheels" the checker lets his expert eye rove over the 250 on the board, quickly spots the rare counterfeits that appear, pulls out any smooth-worn dollars and repeats the process until the bag is filled with a thousand good coins. Then it goes to the vault. Any dull clinkers, homemade of lead or glass, go to the Secret Service. "Early American" models too worn for further service go to Washington for the melting pot.

Now follow the paper trail. Bundles of bills ranging from ones to the $10,000 bills that occasionally change hands in a business transaction or are paid over the judge's desk in a court settlement are routed to their own sorting room. Tens, twenties and higher denominations require a hand sort; a girl takes each bundle of a hundred bills and counts four at a time by hand; then it is verified a second time.

Far swifter fingers, however, are the automatic currency counters. From her hand the operator feeds bills as fast as eyes and human fingers can sort them, into twelve bins, separating them according to bank of issue, fit or wornout condition, and the like. Gold certificates and national bank notes go into one bin on their way to retirement from circulation, for gold has been withdrawn since 1933.

As the wheels of the counter grab each bill and feed it into the proper bin, a meter above that compartment and a master meter for the whole machine register totals. The wheels are so delicately adjusted that the machine stops if two bills are accidentally fed at once. And while she thumbs the green and black bills into the jaws of the counter at two, three bills a second, the operator is watching every one for signs of counterfeiting. Paper that's a shade off color, a tiny flaw in the engraving, a digit or letter slightly over-plump seldom slips past. Last year just 317 spurious bills reached the Federal Reserve Bank of Chicago and only six passed the counting-machine operators unnoticed.

One thing we don't have to tell you is that your money doesn't last long. This problem is of great concern to you, but it also concerns the Federal Reserve, albeit

(Continued to page 149A)

Home Workshop *and* Industrial Plant *both use* WALKER-TURNER Machine Tools

Thousands of Walker-Turner Light Machine Tools are used in home workshops and thousands more in industrial plants. This industrial acceptance of Walker-Turner Drill Presses, Bench Saws, Band Saws, Jig Saws, Flexible Shafts, Jointers, Shapers, Grinders, Lathes and Surfacers is your assurance that they offer you the best value for your home workshop.

Here is the tool you have always wanted . . . *the new Walker-Turner Portable 10" Tilting Arbor Saw.* Built to suit the high standards of industry, yet sold at a price to fit your pocketbook.

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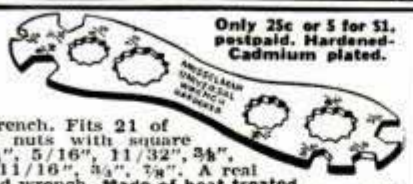
MUSSELMAN FITSALL WRENCH



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SEALS THE PORES OF THE SURFACE
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LASTS SIX MONTHS TO A YEAR
SAVES YOU MONEY

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WE WILL EQUIP YOU with line production machine—raw materials enter at one end—finished products emerge from the other. You operate with one to three men to produce a volume selling up to $200.00 per day.

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INVESTIGATE NOW. Send for free book "FOUR KEYS TO SUCCESS." It will tell you all about this outstanding and complete manufacturing opportunity for you and how better buildings may be built for less. Write today while your territory is still open.

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in your own workshop allows you to design and build your own GASOLINE ENGINES, STEAM ENGINES, STATUARY, ART OBJECTS, SPECIAL TOOLS, NEW INVENTIONS, ETC. You can also make forgings and case harden steel. Your shop is not complete without a FOUNDRYETTE. Three sizes are available capable of making bronze castings of 1¼, 3, and 6 pounds weight, aluminum, copper, brass, etc., in proportion to specific gravity. Domestic gas supply and 110 volt 60 cycle energy required for operation. Prices, $13.50, $19.00 and $27.50, f.o.b. Kansas City. Write for circular.

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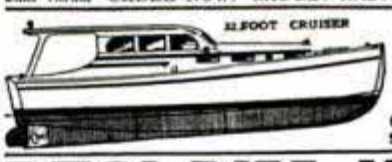

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ONLY 1¢ **So-Lo**

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There's a big demand for the many hand-tooled articles you can make with the Easco Leathercraft Set. Easily learn to make good money in your spare time. Complete outfit including tools, leathers, patterns, etc., and full instructions, only $2.00—on sale at leading Department Stores or order direct and pay postman on arrival. $2.50 outside U. S.

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L. A. SWEET CO. Dept. A-33 **Binghamton, N. Y.**

2 14 & 2

(Continued from page 146A)

in a totally different way. The bank's concern is to take worn-out money out of circulation. A ten or twenty-dollar bill is ready to retire from business in eighteen to twenty-four months. A "fiver" gives up in about sixteen months. But the life of a one-dollar bill is only ten to twelve months. So a million bills a day, wrinkled, tattered and greasy, are chopped up at the Chicago bank. First of all four holes are punched in the unfit currency, then it is sliced in half longitudinally and one half is shipped to Washington; when the receipt comes back, the other half is sent along.

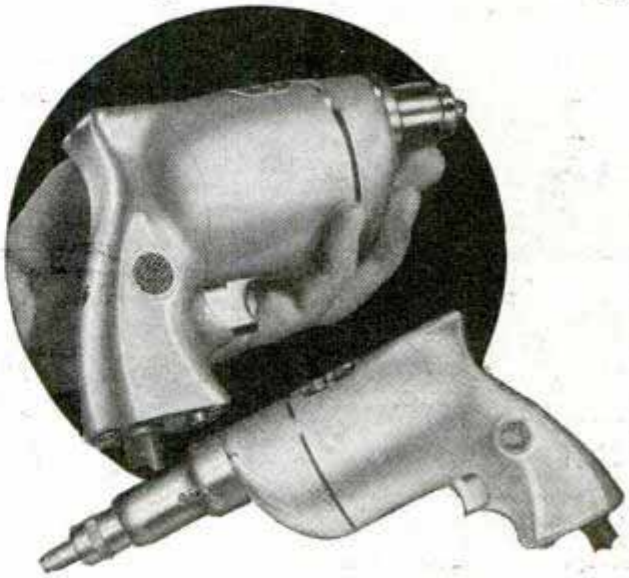
Bills that are robust enough to go back into circulation travel from the counting room to the custodian, who has to recheck every bundle and trundle it into one of the two gigantic vaults, three-level fortresses built of four million pounds of steel and concrete suspended beneath the bank building. In one vault are hundreds of millions of dollars' worth of securities belonging to member banks; the other holds more hundreds of millions in unissued money, millions more in current use and holdings of the R.F.C. and other agencies.

If you have money in the bank, it is very reassuring to know that your bank can store its money and securities behind the massive door of the Federal Reserve vault. It is four feet thick, weighing forty-two and one-half tons, laminated of several different steel alloys of varying hardness to resist torch, drill and explosive. With its frame it weighs seventy-eight tons. Three time clocks govern its opening, and the combination locks require two or more officers to release them. Inside, each teller has his own vault, and it takes two keys and a combination to get in. When you see these steel forts, when you walk through barred corridors with locked doors in every direction, when you visit the police headquarters and watch the working of an intricate alarm system reaching every room of the bank, and you notice on one wall a rack of rifles, sub-machine guns and tear-gas grenades and on another wall a huge display of marksmanship trophies won by bank guards, you understand why there has never been a Federal Reserve bank holdup—not only in Chicago, but in the United States.

A few years ago that check that your

(Continued to page 151A)

TWINS in POWER
for FASTER and EASIER
Drilling and Screw Driving



The compact, new Van Dorn HOLGUN and SCRUGUN easily fit your hand. Small and light, yes—but they're ruggedly built for steady, fast drilling or screwdriving.

Van Dorn's New HOLGUN is a ¼" Drill weighing only 44 ounces and only 6¾" long—but powered for gruelling, continuous operation. With close-coupled construction, minimum spindle offset and hair-line balance, it's ideal for working in tight spots, as well as for general small-capacity drilling.

SCRUGUN, Van Dorn's new screwdriver, powerful as its companion drill, drives a wide range of wood screws, machine screws and nuts and the popular self-tapping screws up to No. 12. Its adjustable clutch automatically drives screws to uniform depth. Ideal for both general use, and for close-quarter screwdriving. Available with right-angle heads for special applications.

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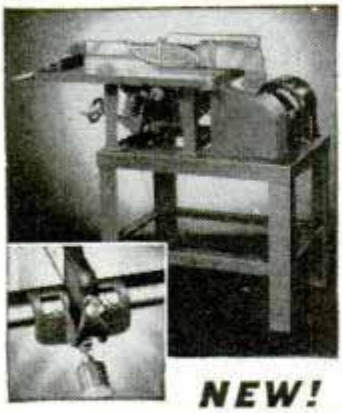

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with exclusive Rolling Pulley Drive that out performs all others.

- Keeps motor cost lower
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- No troubles with lubrication
- Use any motor ½ to 2 h.p.
- Saves 1 motor on saw-jointer
- New dual Rip Fence Control

NEW!

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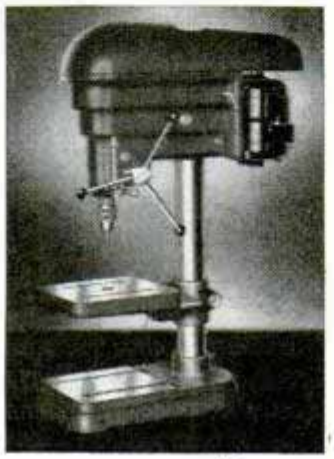
One control micro-sets, fast feeds, and locks rip fence. Faster, handier, increases accuracy. Only our saw has it!



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(Continued from page 149A)

aunt cashed in Spokane might travel around the west for a full month before it came home to roost in your Kewanee bank account, jumping from Spokane to some correspondent bank in Seattle, then Portland, San Francisco and perhaps one or two other banks before it reached Chicago and was mailed out to Kewanee for collection. Now the Federal Reserve's clearing system reduces it to an overnight transaction. Four hundred employes in the Chicago bank's transit department handle an average of 450,000 checks a day valued at nearly $100,000,000, on their biggest day moved 732,000 checks. They are totaled in blocks as they come in from member banks for collection; shot swiftly through endorsing machines, sorted by states and finally into bins of the individual banks to which they must be forwarded. Check sorting goes on twenty-four hours a day. You can't overdraw your checking account with any hope that the check will be three or four days on the road before it comes home to you. Every day the Chicago Reserve bank gets back about 4,500 checks marked "not sufficient funds," and returns them to the banks where they were cashed. Meanwhile funds are constantly being exchanged on the Reserve's leased wire system, which transferred more than $18,325,000,000 for member banks in 1939. At the close of each day the various Reserve banks settle among themselves over these Teletype wires, settling their balances with gold certificates at Washington. For the $1,085,000,000 bank notes in circulation are supported, dollar for dollar, by gold certificates backed by actual Treasury gold.

So the pulse of American trade beats time with the throbbing of currency meters and the ticking of Teletypes in your bank's—and Uncle Sam's—counting house.

Blind Landings Next

(Continued from page 483)

the glide-path beam. Progress of the plane down the beam is indicated to the pilot by the position of a horizontal needle on the cross-pointer instrument. If the needle is above the center, or normal, position it indicates that the plane is above the glide path; if below center, it indicates the plane is below normal position. Thus, the pilot maneuvers to keep the two needles crossed

(Continued to page 152A)

Improve YOUR PHOTO EQUIPMENT *with* KESTER METAL MENDER

You'll find dozens of dark room uses for handy Kester Metal Mender. You can solder clips to wire-holders, repair leaky trays and containers and keep all of your metal photographic equipment in tip-top shape.

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Please send me free sample of Kester Metal Mender and "How-to-Use-It" Booklet.

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Telescope Clamp—Holds telescope rigidly for more accurate observation. Can be clamped on post, tree, or screwed to camera tripod. In leather case, $7.50.

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Your dealer has Louisville Slugger Bats and the Louisville Slugger 1940 Official Softball Rule Book. If he cannot supply you, send 10c in stamps or coin to Dept. P-31 Hillerich & Bradsby Co. Louisville, Ky.

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SOFT BALL BATS

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Superior RADIO RECEPTION! New beautiful big-surface "tear-drop" antenna develops strong, sharp signal! Eliminates distortion from wheel or tire static, high speeds, directional changes. Always efficient despite rain, snow, ice. STAINLESS STEEL—mirror-like, rust-proof, indestructible finish. Mounts easily, 1 bolt. No vibration, no whipping wires or rods.

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FREE! 128-PAGE BOOK ON FISHING

(Continued from page 151A)

at right angles, insuring that the ship is "on course," both in respect to the runway localizer and the glide beam.

The two marker beacons, the outer one two miles from the airport and the inner one near the end of the runway, indicate by means of lights on the instrument panel the instant the airplane is over the marker and thus show the progress to the runway. If the proper approach has been made and the glide path followed, the ship will be sixty feet above the ground when the inner marker light flashes. As a further check, and to permit aural reception, the outer marker sends out dashes on a certain frequency, the inner marker sends out dots on a different frequency.

Location of the glide-beam transmitter some 1,300 to 1,500 feet to one side of the runway prevents it from becoming a hazard to landing aircraft. A monitor and control system is installed in the airport control tower for use in remote operation of the system.

Development of a blind-landing system was started in 1919 by the government, and the first successful instrument landing was made by Lieut. J. H. Doolittle in 1929. Several years of intensive work followed, finally resulting in the system which will be installed as rapidly as possible. Installation does not mean, however, that pilots will begin to land blind immediately. Instead the equipment will be used for practicing the technique of instrument landings on routine, clear-weather approaches, for perhaps a year. But from the day the equipment becomes common on airports and planes, another safety factor will have been added to aviation—the ability in emergencies to "get down somewhere" in any conceivable weather condition.

Another instrument landing system, on which the Civil Aeronautics Authority has been working and on which the scientists' committee recommends intensive research toward its perfection, is that known as the Metcalf-C.A.A.-M.I.T. system. It uses ultra-short micro-radio waves and employs directional radiators shaped like horns because the micro-waves have many of the properties of ordinary light and can be projected in given directions like a beam from a searchlight. Developed to its present stage at Massachusetts Institute of

(Continued to page 155A)

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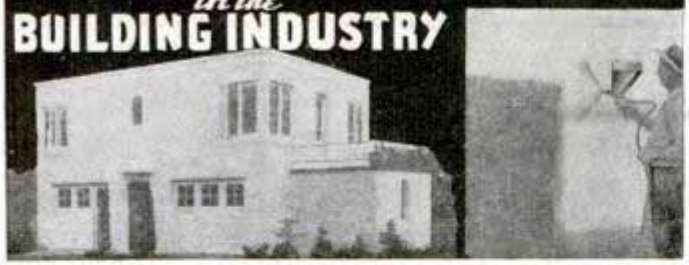

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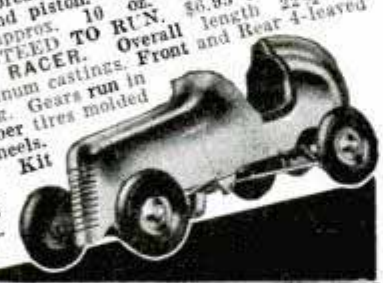

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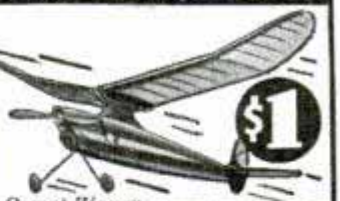

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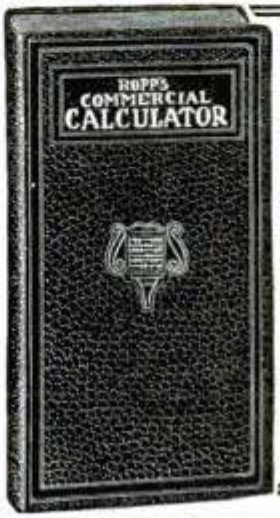

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(Continued from page 152A)

Technology, the system is said to represent a relatively important advance in the utilization of micro-waves. Engineers predict that it may be expected to come into use within one to five years, depending upon the amount of experimental and test work found necessary.

One advantage for the micro-wave system is that a straight glide path can be achieved which meets the ground at a small angle and gives a definite point of contact for each landing. In addition, its glide path is constant in pattern and in angle over the entire distance covered and is not distorted by ground or surrounding objects, meaning that its transmitters can be truly portable, lending themselves to easy removal from one airport to another where the surroundings may be different. The M.I.T. system uses fifty-centimeter waves, less than two feet in length. Its developers predict even greater possibilities, indicating that within two years a ten-centimeter system could be made available.

Horns used in the M.I.T. system are wooden structures, roughly ten feet high, two and one-half feet wide at the mouth and twenty-six feet deep, lined with copper sheeting. The axis of one horn is inclined at an angle of ten degrees to the ground surface, the other at an angle of five degrees. The pattern of the signal emerging from the horns is in the form of a horizontal fan inclined to the earth's surface. The straight-line glide path is generated by feeding the horns with signals of approximately the same wavelength but with different modulation, from transmitters employing very low power, as little as one watt. The two signals, when received, are rectified to produce direct currents which control a vertical indicator in the airplane. The indicator moves upward on the signal of one modulation and downward on the signal with the different modulation. The glide path can be indicated on either a cross-pointer instrument or a cathode-ray "three spot" indicator that carries also the gyro instrument indications.

The cathode-ray equipment is operated so that the center one of three spots on the screen moves up or down, depending on whether one or the other signal of the glide beam predominates. This produces vertical guidance. Horizontal guidance is

(Continued to page 157A)

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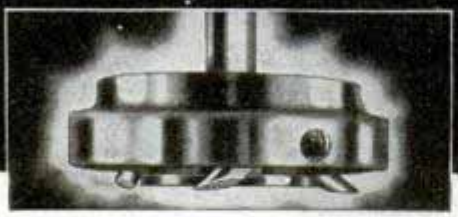

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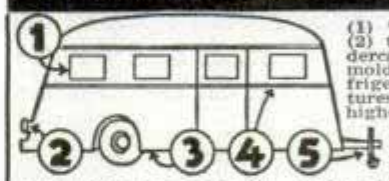

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(Continued from page 155A)

obtained from a localizer transmitter, with the position of the spot again indicating the position of the plane in respect to the runway beam. The instrument also is connected to indicate workings of the directional gyro and the artificial horizon. Thus the pilot simply has the job of keeping the three spots in a straight line on the cathode-ray screen, horizontal and centered.

While the Indianapolis system, with its fixed equipment, apparently meets the usual civil aviation needs, portability is desirable and often necessary for the army, and in general, for the navy. The Washington Institute of Technology has developed a system, called Air-Track, that is characterized by the ease with which it may be moved from one spot to another and used to aid pilots in landing in routine commercial operations on regular airports, or in purely emergency operations. It consists of a truck which contains a gasoline-engine driven generator, a trailer containing glide-path and localizer transmitters, and a motorcycle with van which contains the marker-beacon transmitter and its own gasoline-engine driven generator. Thus the equipment can be operated anywhere independent of external power sources. It also may be used as a completely portable system using airport power at the end of any runway.

Air-Track, usable by commercial planes, would be advantageous for use by military planes in time of emergency, either on regular airports or on fields which have no identifying airport characteristics and which have been located and prepared previously for use in case the regular airports should be destroyed by enemy raiders. The equipment, which could be stored in bombproof shelters until the raid is over, then could be towed to any near-by pasture large enough for landing, set in operation and used to guide home the defending airmen, even in the worst weather.

The "hidden" character of emergency air fields, such as Air-Track might serve, would protect them from enemy bombardment and the instrument landing equipment, if not stored in bombproof shelters, could be camouflaged or actually concealed from observation from the air by parking it under trees.

The navy likewise is intensely interested

(Continued to page 159A)

"No," said Sally
when I asked for a date

I guess I said things when Sally thumbs-downed a date. And she let fly—both barrels. "A little polish certainly wouldn't hurt your *manners*, Johnny Brown," she snapped. "Or your *car*, either," she added tartly.

"Try this Du Pont No. **7** Polish on your old ark," he said, "and see what 'easy' really means." Well, I did. In nothing flat, almost, my bus was positively *dazzling!* So dazzling that Sally, driving home from the movies, said dreamily, "Johnny, did you use that No. **7** on the *moon*, too? It seems *extra* bright tonight!"

Burned? I was so sizzling when I drove off I almost missed a miracle—Tub Smith actually polishing his car! "In love, eh?" I cracked. "No dame is worth the back-breaking job of car polishing." "Back-breaking?" Tub chuckled. "Listen, pal . . ."

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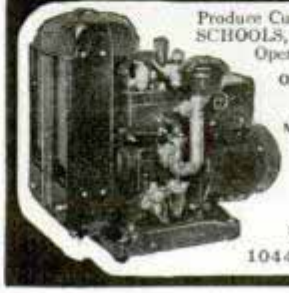

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(Continued from page 157A)

in instrument landings and a new system is being tested at the Naval Air Station, Lakehurst, N. J. It employs two 3,000-foot cables buried beneath the surface of the runways. Running outward from the center of the field in a V-shape, the cables carry a 500-cycle alternating current which sets up a magnetic field. An instrument on the pilot's board then indicates the plane's position in relation to the airport runways. Since the cables are underground, the "magnetic-beam" system is not affected by weather conditions and does not interfere with ordinary radio equipment used by planes flying a beam.

With the problem being attacked on so many fronts, the day of blind landings appears even closer than just around the corner.

Golden Fleece in Your Back Yard

(Continued from page 511)

feeding. Angoras eat about half as much as ordinary meat rabbits. An average angora should consume one and one-half to two ounces of hay and one-half to one ounce of grain daily. They may also be fed such greens as carrots, kale, and green grass. However, care should be taken not to feed green foods in excess, and not too much should be fed at one time. Experience has shown that the feed bill per rabbit per year should not exceed $1.25, and on the average should be around a dollar.

For clipping rabbits, use an ordinary pair of sharp barber shears with good points, a small wire pet brush, and a wooden stand about four feet high. The top of the stand should be covered with coarse canvas to give the rabbit a better grip for its claws. First brush the rabbit well, then part the wool down the back. Shearing is done from the rump forward, line after line. The wool is graded as it is sheared and tossed into containers. After the back of the animal is sheared, the abdomen is clipped. Wool should be left on the abdomen of breeding does. Feet and heads are never sheared.

There are five grades of wool. Number one wool must average two and one-half inches in length and be absolutely clean and free from mats. Number two must be from one to two inches in length, clean and free from mats and shorts. Number three

(Continued to page 161A)

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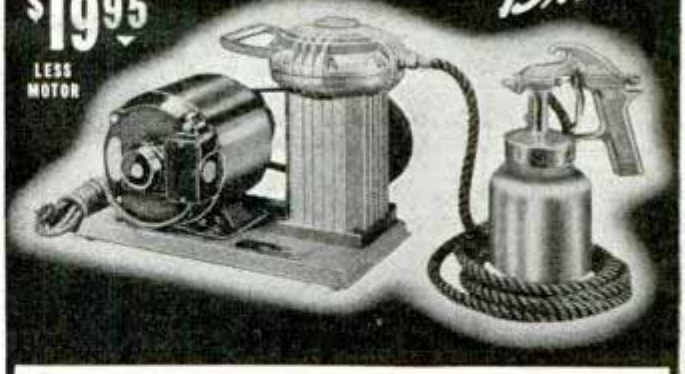

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When writing please mention Popular Mechanics

(Continued from page 159A)

is the same as one and two, except that it is under one inch in length. Grade four is short, clean, but matted wool. Grade five is dirty or stained wool.

The wool may be stored for any length of time, provided some mothproofing agent is used such as naphthalene flakes or crystals. When ready to be shipped, the wool should be placed in cloth or paper sacks (clean flour sacks will do) and each sack should be labeled with the grade and weight of wool. The sacks should be packed in a strong cardboard carton and expressed to the mill or marketing cooperative. Information as to your nearest market and where good breeding stock can be obtained may be had by writing the U. S. Department of Agriculture.

The best wool producers should always be kept as breeders. It is inadvisable to cross breed the French and English strains. Although wool from the French angora commands a better price than the English, French type breeding stock is more expensive.

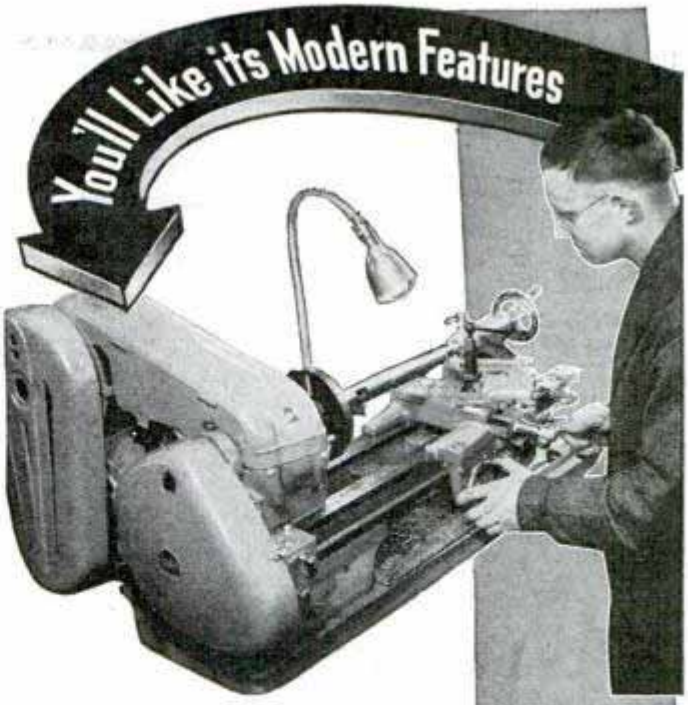
Records should be kept on cards as to the productivity of each rabbit. Such records should give the weight of the rabbit before shearing, the weight after shearing, and the quality of the wool. For identification rabbits should be earmarked. This is done with indelible ink and a small instrument which stamps a number into the rabbit's ear, or with a tattoo needle.

For breeding purposes a nest box should be placed in the breeding compartment. A small nail keg will do excellently. Some clean straw should be thrown into the breeding hutch.

Angoras suffer from few diseases. A herd can almost always be kept healthy by observing a few simple precautions. The hutches should be placed where they get plenty of sunlight, but shaded during excessively hot weather. They should be kept clean and dry.

Angora wool may be home spun with an ordinary spinning wheel. It has a great advantage for home spinning since it need not be scoured or carded, being spun exactly as it comes from the animal.

Although angora raising is a profitable business in itself, it has a vast field as a clean, simple, and pleasant way of producing additional income in your own back yard—a modern golden fleece.



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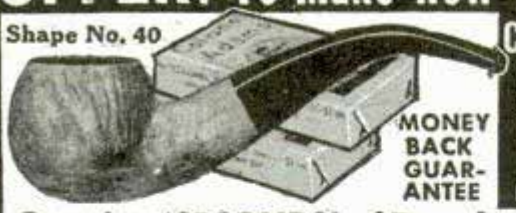

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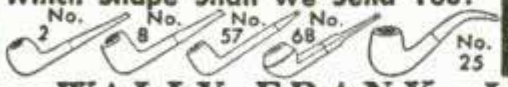

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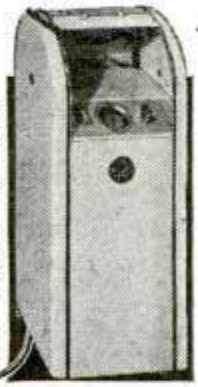

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